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INDEX TO

# CANADIAN MACHINERY
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VOLUME VIII

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# Double-Cutting and High Speed Planing Machines *

By J. Hartley Wicksteed **

*The writer makes a strong plea for the elimination, to the fullest extent possible, of the idle return stroke, and shows that such advantages as reduced wear of tools per unit of surface planed, increased quality of product and larger output are now available through the utilization of proper drive mechanisms and equipment.*

THE Planing Machine with its idle return-stroke is necessarily inferior in principle, for the economical removal of material, to a lathe with its continuous-cutting action; nevertheless, plain surfaces are best done on planing machines. The problem of minimising the time spent on the idle return-stroke has naturally received great attention, with the result that, in some cases, it has been reduced to one-tenth of that consumed in the complete cycle of the table; but, why do we not eliminate the idle stroke altogether, and make the machine cut equally on both the forward and backward strokes? It is hoped that, in the following paper, the conditions will be explained under which this is undoubtedly the most ecnonmical method, and also the conditions under which single-stroke cutting should be preferred.

### Change-speed Reversing Motors.

The recent development of change-speed reversing motors has overcome the chief objection to an extended use of the double-cutting principle. With an equal speed to the planing-machine table on both the forward and backward cut, it followed that, when the work did not permit of the use of both tools, due to want of clearance at the end of the stroke, as, when planing in a steam-chest, the absence of a quick return-motion on the idle stroke discounted the advantages gained on other work where double cutting could be employed. With the variable-speed reversing motor, the drive can now be set either to reverse at equal speeds for double cutting, or to drive slowly on one stroke and quickly on the other, when necessary to plane only in one direction. Thus, in the machine illustrated by fig. 1, the table is driven at speeds varying between 20 and 60 feet per minute, on either stroke. The motor is regulated by varying the field strength, and will stand heavier intermittent loading at the lower speeds than at the higher; hence, it will exert the full horse-power at all speeds, the torque on the motor-shaft being approximately inversely proportional to the speed. Again, the slower the speed at which the table is driven, the heavier is the cut that can be taken. In general, the machine cuts on both strokes, but the double-cutting tool-holder can be removed and a strong single tool-holder substituted, capable of carrying a long projecting toolstock for heavy cuts on steel, in cases where the work does not lend itself to double cutting.

### Double Cutting on Cast Iron.

In planing cast-iron, the advantages o double-cutting are twofold, for, beside having two feeds to the tool-box on eac cycle of the table, the back-to-bac tools mutually assist each other b chipping away the scale in front of the in either direction, so that each tool ha clean metal to enter at all the edges o the casting with which it comes in con tact. The tools are thus saved fro so much wear that, instead of two tool requiring more fixing, they require, o the whole, less than does a single tool the reason being that the back-to-bac tools so save each other from wear tha they do not need to be removed and re fixed during the progress of the work for the purpose of re-grinding. Again the first roughing cut is more uniform i made with two tools, because they ge so much less worn between the first cu and the last, partly because each too only takes alternate cuts, thus reducing the wear to half what a single tool would be subjected to on one job and with one setting, and further, because of the assistance which each tool has rendered to its companion in preparing clean metal at all the edges where the single tool would have had to face hard scale.

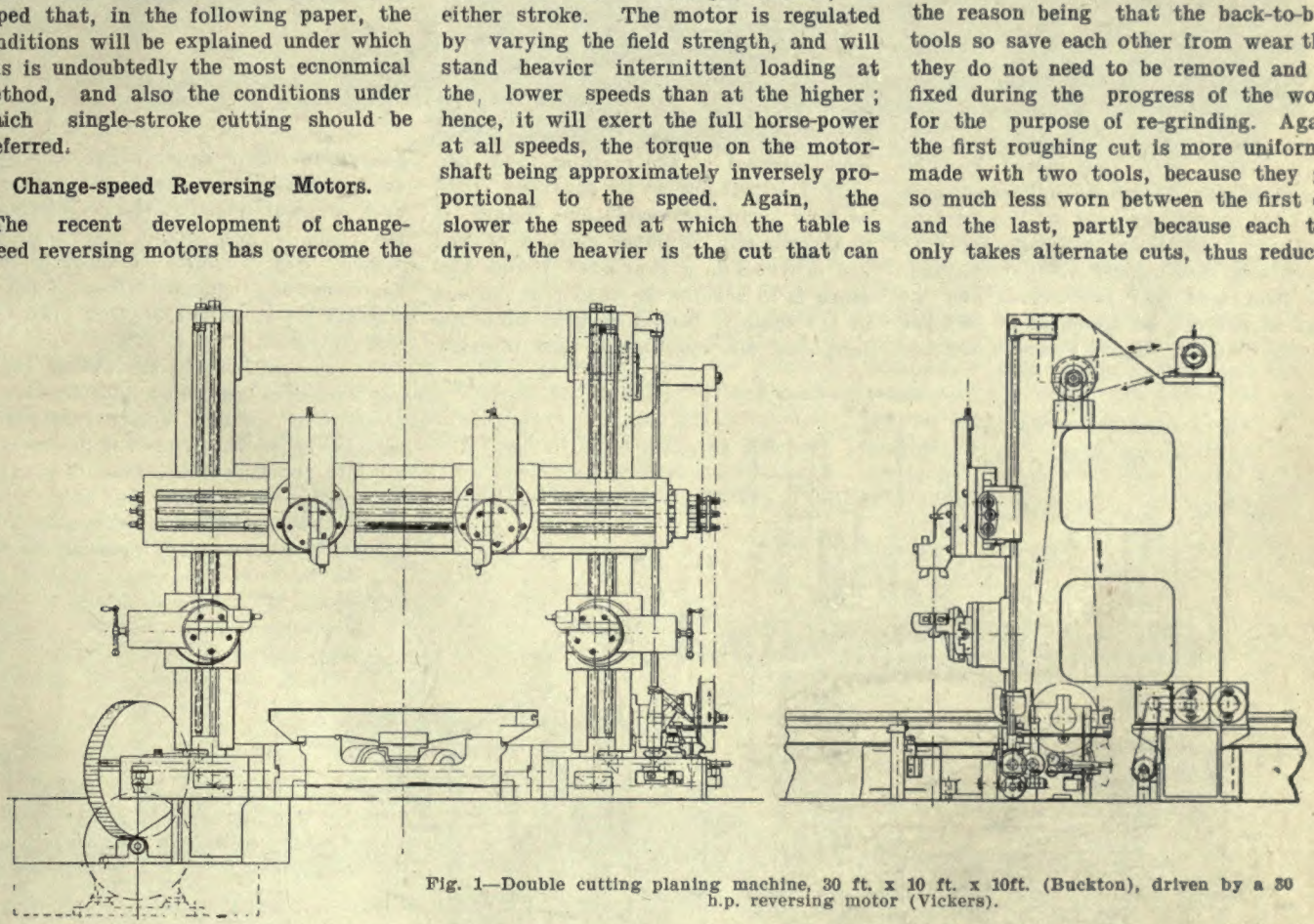


Fig. 1—Double cutting planing machine, 30 ft. x 10 ft. x 10ft. (Buckton), driven by a 30 h.p. reversing motor (Vickers).

*Abstract of paper read before the Institution of Mechanical Engineers (Eng.), Nov. 17, 1911.

**Past President, Leeds, England.

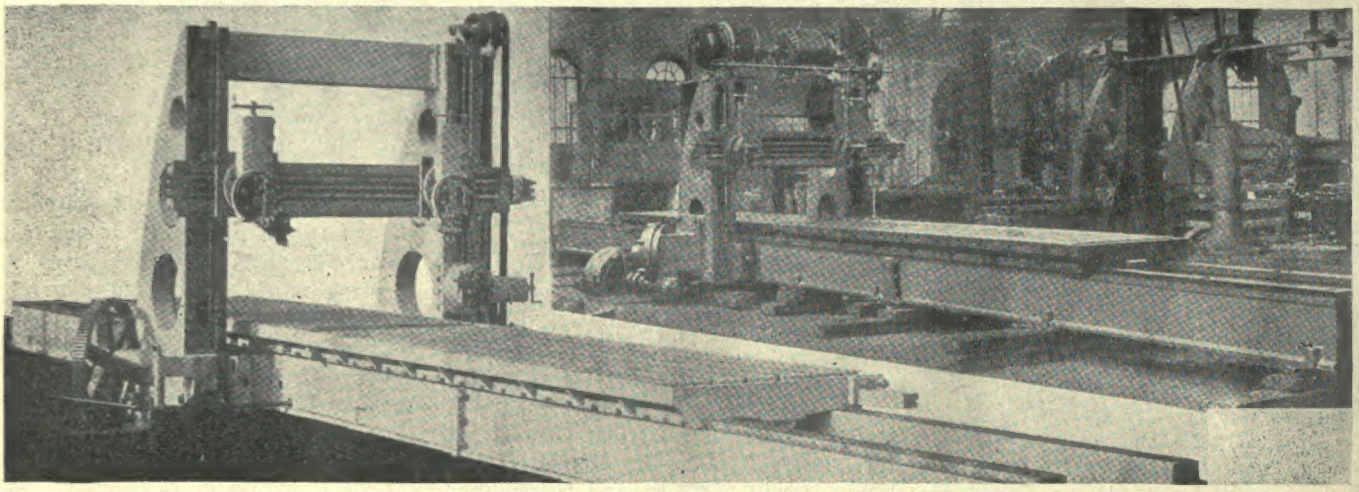
It has been found that turbine casings, for example, could be planed true in less time by double than by single cutting, even if the time taken by the idle return-stroke were eliminated altogether. The reverse position of the back tool also makes it particularly advantageous for taking broad finishing cuts ; it does not require cranking back to prevent making chatter marks, because it has no tendency to dig into the work. For the same reason it can be advantageously used for cutting grooves with a parting tool. In these cases, although the double-cutting tool-holders are not changed, the back tool only is inserted and the back stroke can be driven at 20 feet per minute, with an idle stroke, on the usual forward stroke, of 60 feet per minute. There are also occasions where it saves turning the work round end for end to have a tool available for planing up to an obstruction in either direction.

### Feed of Tool Boxes.

The feed of the tool-boxes is effected by a continuous running belt-pulley and a friction-clutch, which is thrown in at each reversal of the machine, and permits the belt-pulley to take one, two, or four complete revolutions before it is thrown out. Further changes of feed are provided in a gear-box. If one tool alone is in action, the tappet at one end of the table is turned back so that the feed does not operate on that reversal. The manner of double-cutting is to fix both tools precisely back to back ; in fact, the second tool is adjusted by simply dropping it into the furrow made by the first tool. The back tool follows in this furrow until the end of the stroke, when it receives a feed motion. It then cuts a further furrow in which its companion follows free, and thus, on a single cycle of the table, two furrows have been cut of equal width and equal depth. Assuming a feed of $\frac{1}{8}$ inch at each reversal, then, at the completion of the cycle, $\frac{1}{4}$ inch would have been traversed. Fig. 2 shows a constant-speed double-cutting planer driven from a line-shaft. It planes 36 feet long by 8 feet square.

Fig. 2—Constant Speed, Double-cutting Planer (Buckton). Driven from a Line Shaft.

Fig. 3—Variable speed planer with tandem tables (Buckton). Driven by a 50 B. H. P. Electrical set.



It is astonishing to the author to see any machines put down for the express purpose of planing engine base-plates, machine-beds, table, or tank-plates, with an idle return-stroke even if provided with gang tools, when two back-to-back tools would do all such work with much greater economy in the wear of the cut-

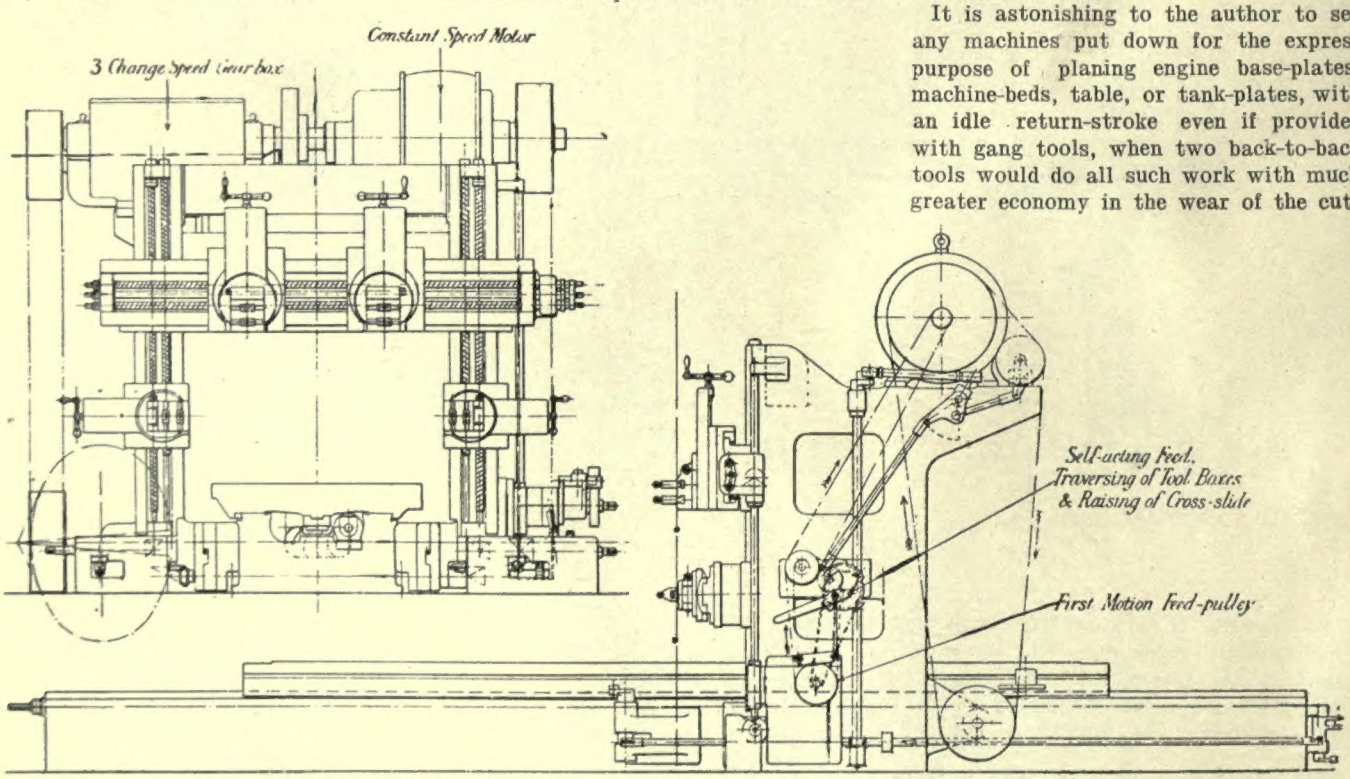

Constant Speed Motor
3 Change Speed Gear box
Self-acting Feed, Traversing of Tool Boxes & Raising of Cross-slide
First Motion Feed-pulley

Fig. 4—Planing machine, 16 ft. x 5 ft. x 5 ft. (Buckton), driven by a 30 h.p. motor, 600 R.P.M.

ting tools, the wear and tear of the machine, the cost of driving power, the time of doing the work, and the quality of the work done.

### Advantageous Single Cutting Conditions

It must be conceded, however, that for work of great variety, and in some cases for special work, the bulk of which may only lend itself conveniently for cutting in one direction, the saving of as much time as possible on the idle stroke is very advantageous. For instance, in planing railway switches, with heavy cuts on very hard steel, it would be dangerous to enter a tool in the direction of facing the point, consequently, this special work is done cutting on one stroke, and the quickest possible idle-return. In miscellaneous work, also, fixed to the table by cramps and bolts which may interfere with the 6-inch over-run of the back-to-back tools, there are advantages in cutting in one direction only. As a consequence, on machines of moderate size, where practicable to get a quick return of about 8 to 1, it is hardly worth while to have a double equipment of tools and tool-holders, especially, as, on short jobs requiring right and left-hand tools for planing down vertical faces, or for undercutting, or for rounding the corners of the work, the single-cutting tool-box would be almost constantly in use.

### Various Types of Machines.

Fig. 3 shows a machine with tandem tables, each of which will separately plane 16 feet long by 5 feet wide by 5 feet high. It will cut at any speed from 17 feet per minute to 60 feet per minute, and return at 136 feet per minute. It is driven by a 50-b.h.p. electrical set made by the Lancashire Dynamo and Motor Co. The motor generator is placed upon the top of the machine and runs at a constant speed. The motor is driven from the mains and can be either alternating or direct current. The generator supplies current to the planer motor, the voltage of which is varied, thus giving changes of speed on the machine over a total range of 8 to 1. The machine will take the same strength of cuts at any speed from 17 feet to 60 feet per minute, the horse-power given out by the planer motor being directly proportional to the cutting speed.

The next machine to be described is of exactly the same strength as the foregoing. It gives the same weight of cut at slow speeds and has the same ratio of quick return; but, instead of being driven and reversed by a reversing motor, it is driven either by a belt from the line-shaft or by a continuous-running motor. Fig. 4 shows the machine, to plane 16 feet by 5 feet by 5 feet, driven by a 30-h.p. motor running at 600 revolutions per minute, the power being delivered through belts to the machine. The belts do not shift on fast-and-loose pulleys but are themselves tightened and loosened alternatively, and at half stroke of the jockey-pulleys, each runs loosely in a loop under its respective pulley without touching it. The cutting speeds are 17, 35, and 60 feet per minute, and the return speed 136 feet per minute. The machine has a self-contained countershaft, which may be belt or motor-driven, and two open belts, as has been said, to convey the reverse motions to the cutting and return strokes. One belt for the quick return is driven from the countershaft or motor-spindle, the other belt for the variable cutting-stroke is driven through a three-speed gear-box. The gear-wheels run in oil and only one pair is in mesh at a time, namely, the pair giving the speed required for the cut in use. On account of the drum of this belt being driven through single-purchase gearing it runs in a contrary direction to the quick-speed belt, and, therefore, reverses the machine without being crossed, which enables it to drop plumb round its pulley. Each belt encloses a jockey-pulley. The pedestals for the jockey-pulleys are adjustable, so that a good endless belt never requires taking up and joining. Both jockey-pulleys are thrown from the same rocking shaft, and when the reversing gear rocks this shaft in one direction, the driving-belt is tightened by its jockey-pulley, and when it rocks in the contrary direction, the driving-belt

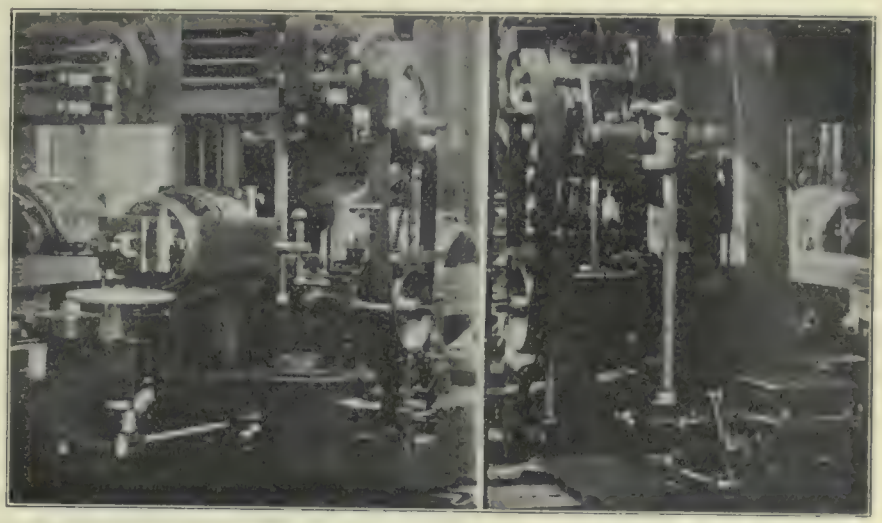


Fig. 5- Mechanism for feeding and traversing the tool boxes and for raising the cross-slide on large planing machines (Buckton).

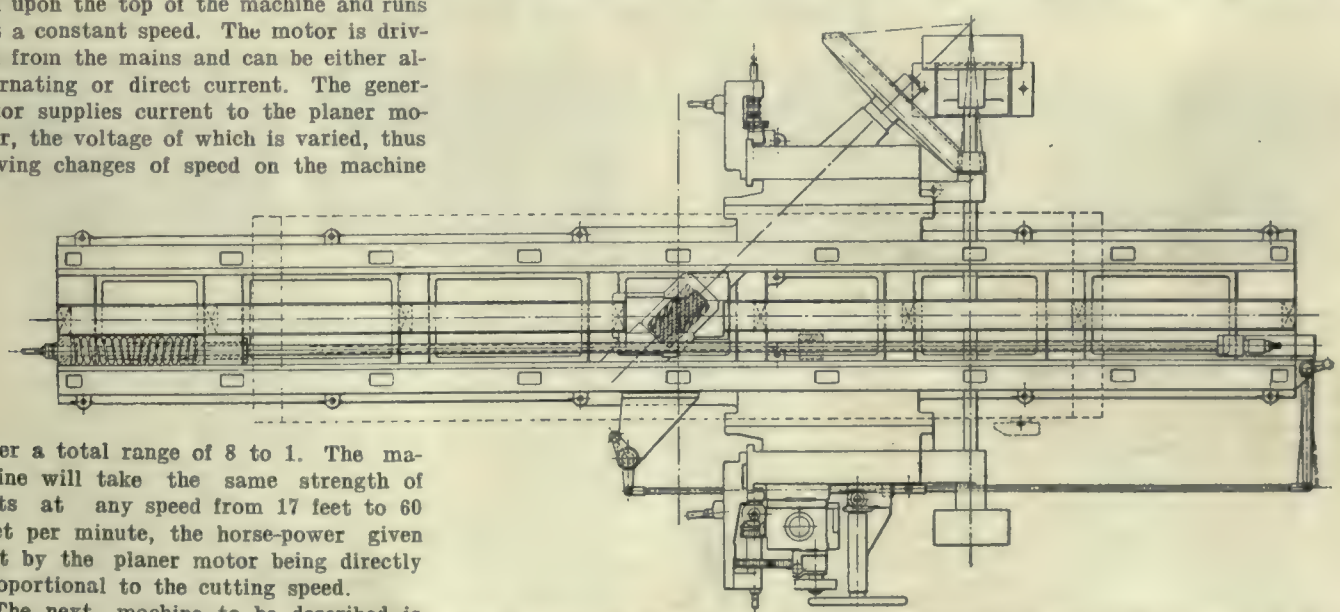


Fig. 6—Planing machine, 16 ft. x 5 ft. x 5 ft. (Buckton), showing reaction spring for high speed return stroke.

is loosened and the quick-return belt is tightened. The belts are endless belts from the makers' works without any laced joints or metallic joints, and any stretch that ensues in a new belt is taken up by moving the position of the jockey-pulley. The grip of these open belts is so smooth upon their pulleys that there is not the slightest knocking on the gearing, at reversals, of the machine. They themselves form a most perfect friction brake drive, and no cushioning device or friction coupling is required. The belts are 8 inches wide, and, as they are not subject to contrary flexure round the jockey-pulleys, and encounter no edge friction from belt striking fork, they are exempt from the elements of self-destruction usually found in heavy planing-machine belts.

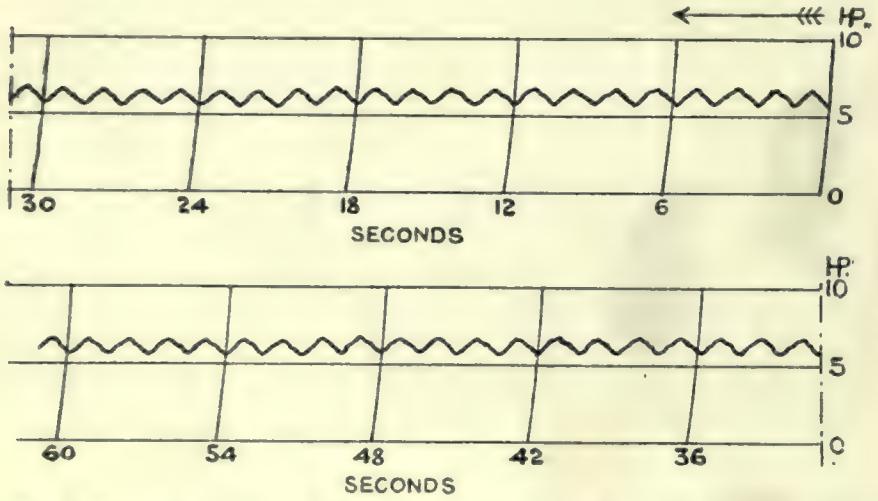



Fig. 9—Power diagram from planing machine, 10 ft. x 4 ft. x 4 ft. (Buckton), 40 cycles per minute.

### Belt-driven Planers.

It is, perhaps, needless to say that the chief inertia in stopping or starting a belt-driven planer resides in the rim of the driving pulley. During the quick return-stroke, the shaft of this pulley makes about 800 revolutions per minute, and it is obvious that if this shaft be driven by a pulley 24 inches diameter with 8 inches face, instead of a pulley 48 inches diameter with 4 inches face, the weights of the pulley-rims would be about the same, but the peripheral speed of the one would be twice that of the other, and the inertia to contend with in the larger diameter pulley would be four times that in the smaller diameter pulley, although the belt driving power would be the same. Therefore, by using broad belts of low velocity instead of narrow belts of high velocity to deliver the power of the motor on to the cut, the chief inertia has already been reduced enough to enable the return speed to be doubled without increasing the inertia of the pulley rim. Incidentally the broad slow belt is a better brake than the quick narrow belt an account of its broad surface and low velocity.

The author does not claim to have discovered the advantages of the broad slow belt for reversing pulleys. That principle was first introduced by Mr. W. C. Mitchell, and has been applied by him to many heavy planing machines. His system is that of tightening and loosening belts by jockey-pulleys acting upon the outside of the belts, and the chief difference in the author's system is that the jockey-pulleys act upon the inside of the belts and that the rocking shaft which works them is rocked from a crank-pin semi-revolving, so as to reach opposite dead centres at each reversal.

### Inside Tightened Loose Belt Applied to Feed Motion.

The same system of a loose belt tightened from the inside is also applied to the feed motion. When the handle, Fig. 5, of its jockey-pulley frame is lifted, the feed motion runs continuously for traversing the tool-boxes and for raising the cross-slide. When the handle is dropped, the continuous motion ceases, but when the machine is running, a lever, from the rocking shaft which throws the main jockey-pulleys, pulls a pawl lever engaging into the frame of the feed-motion jockey-pulley, and thereby tightens the feed belt, just at the end of the quick-return stroke. As soon as this tightened belt has driven the first motion of the feed gear one revolution, it has also turned a stripping disc ¼ of a revolution, stripped the pawl out of engagement, and allowed the handle to drop, loosening the belt, and, at the same time, pressing a brake upon the feed-pulley to prevent over-run, and has given a feed of 1-32 inch. The stripping disc has four wipers, which, when all are in operation, strip the jockey-pulley after the first motion feed-wheel has made one revolution.

The wipers can be turned down, and, when only two are left in action, the feed-pulley receives two revolutions before the pawl is lifted, and the feed becomes 1-16 inch. When only one is left, the feed-pulley receives four revolutions before the pawl is lifted, and the feed becomes ¼ inch. The first motion feed-pulley drives through two change-gearings, and when the quicker gear is thrown in, the feeds obtained from the stripper plate become ¼ inch, ½ inch, and 1 inch. By this simple automatic gear, therefore, six rates of feed are obtained varying from 1-32 inch to 1 inch.

The tool-boxes can be traversed without altering any clutches. For example, assuming that a feed is operating upon one of the tool-boxes, and, in order to pass over a part which does not require planing, it has to be traversed 12 inches to come up to its fresh cut, then, without making any change in the feed-gear, and by simply holding the jockey-pulley into the belt by its hand-lever, the motion becomes continuous instead of intermittent. The moment the hand-lever is dropped, the intermittent feed-motion is resumed. The direction of traverse is reversible by a handle. All

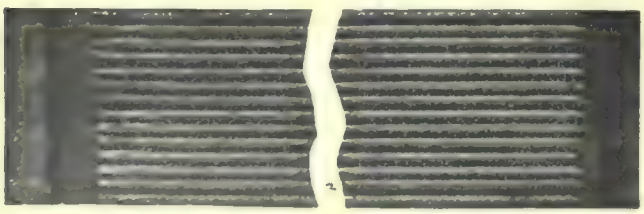


Fig. 7—Length of stroke, 12 inches. Between landings, ⅜-inch and ⅛-inch wide.

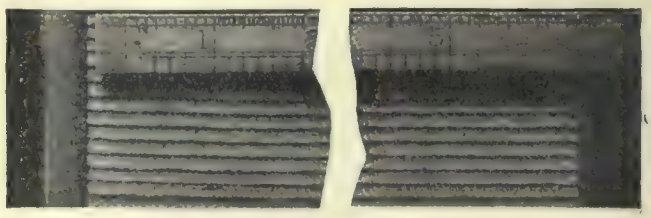


Fig. 8—40 cutting cycles per minute, with table reversing 80 times per minute. Length of stroke, 6 inches. Between landings, ⅜-inch and ⅛-inch wide

SPECIMENS OF WORK FROM SPRING-BALANCED PLANERS (BUCKTON).

the feed-motions and the traversing motions of the tool-boxes and the raising and lowering of the cross-slide are effected by power from this same continuous running belt. The table is driven through a rack by Sellers' spiral gearing. The guides of the table and bed are flat horizontally and slightly undercut at the sides. The table therefore cannot lift under any circumstances.

### Reaction Spring Equipment.

The plan view of this machine, Fig. 6, shows the arrangement of a reaction spring placed in the bed of the planing machine, which enables it to attain the speed named without distress upon the return belt or overload upon the prime mover. It will be seen from the drawing that there is a boss cast on the second cross-bar at the front end of the bed, and abutting against this boss is a spiral spring about 2 feet long. Through this spring, a screw-shaft is passed, carrying a collar to press against the outer end of the spring, and also carrying a heavy nut against which a lug, cast solid under the table, impinges. By turning the screw-shaft, the nut can be traversed over a length of 16 feet into any position desired for the reversal of stroke. When the lug under the table impinges upon its nut, it moves the screw-shaft endways, and by the collar at one end compresses its spring. On one end of the screw-shaft a cam-plate is carried on a crosshead, and the end movement of the screw, carrying the cam-plate with it, moves the lever of the belt striking gear, and thus the same movement of the screw-shaft compresses the reaction spring and reverses the drive. The synchronism of these two operations is not disturbed by turning the screw round and altering the position of the nut to adjust the length of stroke, and this can be done even while the machine is in motion. The place, at which the table ends the cutting stroke, always corresponds with the position of the nut, namely, anywhere over the 16-feet range of the screw-shaft. The screw is 1 inch pitch, which is convenient when the operator is setting the stroke for exact clearance, as each full revolution of the screw alters it a known inch. The screws can be turned by hand so rapidly that an adjustment over a range of 10 feet can be effected in 1 minute. At the end of the screw-shaft, passing through the spring where the cam-plate is placed for reversing the table from the cutting to the idle stroke, it will be seen that there is a little space between the cam-plate and the belt striking lever. This is to give a late cut-off to the belt striking gear so as to prevent the driving belt being loosened before the spring is sufficiently compressed. While the cam-plate is passing through this space on the 60-feet cutting stroke it is compressing the spring, wholly by the residual energy of the moving masses, and when the space is covered and the lever kicked, the spring has made a dead beat of 4 inches.

The scale of this spring is 1 ton per inch, giving a terminal pressure of 4 tons. Thus, at the end of each cutting stroke, the spring being compressed 4 inches, there is, at the moment of the table reversing, such a thrust upon it as will help to start it on its quick-return journey. The quick-return belt is thereby greatly relieved, as it is not called upon first to take out the kinetic energy of the table and the revolving pulleys in one direction, and then to supply a further amount of energy to accelerate them in a contrary direction, but, instead of this, the whole of the residual energies of the revolving parts and of the moving table at the end of the cutting stroke are stored up in the spring, and are immediately returned by its reaction, to assist in starting up the quick-return stroke.

When the speed of cutting stroke is 60 feet per minute, more than the necessary amount of work is supplied to compress the spring by the kinetic energy of the moving parts, but when the table is driven at its slowest speed of 17 feet per minute a little assistance is required from the drive at the end of the cutting stroke to complete the compression of the spring. Seeing, however, that the drive is from a constant-speed motor and acts through 3½ times the multiplying power of gear when the cutting speed is at its slowest, it happens that at the very time when there is a deficiency of energy in the moving parts for the complete compression of this spring, there is a surplus of power in the drive, beyond what is required to complete the maximum cut, without putting any overload upon the motor. By the reaction of the spring described, the table has a good send-off at the beginning of the quick return-stroke, and no dwell is perceptible at the point of reversal; there is no shock on the gearing, and the curve of the power diagram does not rise above the full-load line.

### Spring Action Effects.

The following detailed description will explain the action of the spring. The table, when ready for starting its return stroke, is under the influence of a spring compressed to a load of 4 tons and stored with 8 inch-tons of potential energy, which, being regulated by the speed of the return belt, it delivers to the table in 4 inches of travel. The 30-h.p. quick belt with this assistance is able to accelerate and keep the speed up throughout the stroke, without heating the pulley. Further, the machine will at all times work dead beat between two walls, and plane up to ¼-inch landing. The reversal at the end of the quick-return stroke is dealt with quite satisfactorily by the broad belt on the 24-inch driving pully, and this belt motion is struck from the usual form of knocker on the table. The machine will work with certainty at full speed and let the tool drop without marking the work between landings of ⅛ inch at the start and ¼ inch at the finish, fig. 7. The reduction in idle clearance-spaces and the command of good feed-traverses, ranging from 1-32 inch to 1 inch, contribute greatly to the large output of work which has been realized with this machine. By this system of drive with continuous running prime mover, the full power is available at all speeds, and the heaviest chips can be taken at the slowest speed.

The power of the machine, as described, is equal to a 10-ton pull upon the table at the middle speed, and a 15-ton pull at the slow speed. The speeds given are such as could be worked continuously without heating or irregularity down to 12 inches length of stroke. If made without a re-action spring, the return speed, instead of being 136 feet per minute, would be 110 feet per minute, and if driven by shifting belts and without re-action spring, 90 feet per minute.

It will be readily understood that in proportion as machines are made for lighter cuts, they can be returned at quicker speeds, because, as has been said before, the chief inertia lies in the rim of the driving pulley, and this rim must needs be made in proportion to the weight of the cut required. Thus, in a 4-foot-square machine, with a 5-ton pull on the table, fitted with a re-action spring, the quick return of 160 feet per minute can be given, or in a quite simple machine for light cuts, with about 1-ton pull on the table, a return speed of 240 feet per minute is attained without the assistance of any springs. On the other hand, it should be borne in mind that, in a machine for extra heavy cuts requiring a 20-ton pull upon the table, the judicious return speed would be less than that quoted in proportion as the power might be greater.

Reverting finally to the 4-foot-square machine just mentioned as returning at 160 feet per minute, fig. 8 shows photographs of work done on a 6-inch stroke, making 80 reversals per minute, and fig. 9 is the power diagram taken at the same time. In this machine there were two re-action springs, one of which was compressed by the table at the end of the cutting stroke, and the other similarly compressed at the end of the return stroke, so that the table ran in almost complete balance, as shown by the nearly horizontal line on the power diagram. Each hump on that line shows a cycle of the table, 40 of these cycles being completed per minute, involving 80 reversals.

# Technical and Industrial Education for the Mechanic*

By Robert Patterson**

*The increased and widespread attention being given to the subject of technical and industrial education in our large manufacturing centres makes valuable and timely every expression of views thereon by men whose position affords opportunity to determine the benefits, personal and collective, that accrue from its practice.*

BEING interested in the training of apprentices for the mechanical trades and artisans in general, papers read or discussions on the subject, have always been of great interest to me, and when asked to say a few words before the members of your Exchange, I selected this subject, not so much perhaps with a view of imparting new information, as with a view of bringing before you a matter that is of great importance, requiring careful study and attention of the industrial communities of Canada, and those responsible for the proper education of Canadians to-day.

### The University Graduate.

The title of my subject to-night might give you the impression that I favored the university graduate, but I might say here that I only partially approve of same, and that a system of combined practical, technical and industrial education should precede any such course.

Papers without number, and discussions without end, have been dealt with to try and settle the question as to whether the university educated man or the practically educated man has been the most successful in giving the best results to his employers and the mechanical and industrial world at large.

Although there have been numerous university graduates who have shown great brilliancy and accomplished much, yet the practical man has not by any means been outclassed, and is holding more positions of high responsibility and trust, to-day, than his university graduate competitor. However it is not this phase of the subject I wish to dwell upon, but the technical and industrial education of the average mechanic or artisan, and the system of education by which it may most successfully be accomplished, both as to thoroughness and economy of time.

### Manual Training Desirable.

In this young and growing country of ours, the rapid growth of steam and electric railways, and the vast increase in manufacturing industries, have created a demand for increased and more rapid facilities for doing the work, and for producing mechanics and artisans of all kinds to keep pace with the development. The future will create a still more urgent demand, and to meet present and future requirements a quicker and a more thorough system of education will be necessary to provide properly trained men to meet those requirements.

The men at the head of our public educational system to-day have already realized this, and as a result the boys in our public schools are given manual training. The system should be in force in every centre in the country. It would help parents and guardians by enabling them to judge of the fitness of the boy for his future profession, industrial or otherwise.

It is a great assistance to the boys who intend to enter the industrial profession, and best of all it is teaching them to appreciate, respect, honor and have a desire for honest manual labor, an attitude of mind which will be of incalculable benefit to the individual, and produce a beneficial effect on the country at large.

ROBERT PATTERSON.
Master Mechanic, the G.T.R. Shops, Stratford, Ont.

To begin with, the boy or young man who intends to become a mechanic, or enter any of the industrial pursuits should have a partial high school education, so to ensure a good groundwork for his further development.

During his progress through the shop, and while learning his trade, in addition to his every day instruction, which ought to be under the supervision of a thoroughly trained and competent instructor, his technical training should go on at the same time, and it should be just as much a part of his duties as

*Abstract of address delivered before the Builders' Exchange, London, Ont., on December 7th, 1911.

**Master mechanic, G.T.R. shops, Stratford, Ont

to turn bolts, fit up a motion, build a stairway, make a writing desk or any other class of work which he is learning to do. In other words, a boy or young man's practical and technical training should be combined, and go hand in hand.

**Present School System Requires Amendment.**

To accomplish this, I believe our school system should be considerably changed. At the present time the curriculum is furnished by the educational department for our schools, to be strictly adhered to, and as a teacher's qualifications and abilities are judged by the number of pupils which he turns out each year who obtain successful passing marks at the regular examinations, it practically leaves no scope for his individuality, no matter how much he may possess.

A very large percentage of our pupils follow the commercial or industrial lines after leaving school, and yet they are not specially fitted for these, as the whole system of education appears to me to tend toward a general training for university purposes, whereas a very small percentage go to the university.

For instance, it has been my experience and I am sure it has also been the experience of a large number of business men here, that you will find children nine to eleven years of age in our public schools able to read intelligently, write and spell well, and do arithmetic up to long division correctly. When we get these same boys making applications for positions as apprentices in our shops, or in our stores as clerks, we find in a great number of cases, they are not able to spell, write well, or do ordinary arithmetic up to long division correctly. This is when they have arrived at fourteen or fifteen years of age.

**Training for Accurate Work.**

I think it will also have been your experience that they have not been trained to work accurately. This is the result of crowding of their numerous courses to cover the curriculum. The fair grounding in the rudiments which they get at nine to eleven years of age is not followed up or continued so as to give them a thorough grounding. Our educational authorities have seen fit to abolish the fifth book in our public schools in a great many cases, expecting the pupil to follow into High School for this, but many of those people cannot afford to send their boys to High School, and have to put them to work, and in consequence they do not receive the education, or the groundwork to build one on, which is necessary for them to have to make intelligent mechanics or commercial men.

In most cases, in fact I might say in all our public schools there is an absence of the teaching of practical drawing, geometry or algebra, which subjects were taught in our schools twenty-five or thirty years ago.

**Apprentice Training Systems.**

While the Manual Training School, if properly conducted and the teaching along practical lines, could remedy a great deal of this, and should, yet up to the present time the instruction is not practical enough, owing to the fact that the teachers in few instances have had practical experience in actual requirements of industries, and I might say the same applies to commercial instructors as well.

In large industrial establishments, and particularly on railroads, the progress has been so rapid during the last few years, that it has become necessary for corporations to start systems for educating young men and apprentices in their own works, as it was found that the supply was becoming totally inadequate to meet the demands.

For instance in the shops over the Grand Trunk System a very thorough system of apprenticeship is in force. A boy desiring to get into our works as an apprentice requires to be between the ages of fifteen and nineteen years. He must be able to read, write and spell intelligently, and do mathematics up to, and including, decimal fractions. If he passes this examination, he is then sent to a medical officer of the company, who examines him physically to see if he is capable of learning the trade, and becoming a mechanic. If he meets these requirements he is then placed in the shops as an indentured apprentice, the indenture binding him for five years. The rates of wages are fixed so as to give him an advance each year.

In addition to this it is compulsory for him to attend instruction classes two nights per week from October 1st until April 1st. Each year examinations are held over the entire system, and apprentices in all the different shops compete. One night a week is devoted to "Mechanical Drawing" and another night a week is set apart for "Practical Mechanics." At the examinations the papers are prepared by outside parties, and when they are turned in they are also examined by outside parties, so that they do not know which shop the papers come from, nor any of the individuals who compete at the examination.

A diploma is then given by the company for the class that takes the highest average marks. In addition to this individual prizes are given at each shop to each class of apprentices and for each year of service. This stimulates the boys and there is a very keen rivalry over the whole system to have their class obtain the highest average marks, and also for the individual boys to strive to obtain the individual prizes at their own station.

Each year before the apprentice gets his advance in wages he undergoes an examination in drawing and mathematics and the advance is only given on his being able to obtain the percentage of marks required.

In the event of a boy not being able to pass this examination he is given a second trial, and if he then fails, he is dismissed from the service, for the reason that he is either too stupid to learn the business or too indifferent.

As a consequence, after five years practical training in the shops, and five years technical training at these classes, the Grand Trunk always have a corps of well trained young men, who are able to fill any of the positions which become vacant.

**The Educated Mechanic a Necessity.**

An educated mechanic on railways is very much required to-day, and I am sure you find it so in all branches of industry, but very particularly in railroading, as advances have been so pronounced during the last few years. Heavy power, high steam pressures carried on the boilers, makes it absolutely necessary that we should have the most intelligent men to work on them, and also to construct them.

Tuition for these apprentices is entirely free, teachers, room, light, etc., being supplied by the company, also drawing boards, tee squares and text books, apprentices only being required to find their own drawing instruments and give their attendance. The company also gives two scholarships per year, the successful apprentices receiving four years' free tuition at McGill University.

I believe if this system were extended, and it is a point I wish particularly to emphasize, we would soon have a body of well trained young men able to take positions in every walk of life that was necessary for them to fill, and every well regulated establishment should have young men of this kind coming along. It would keep up the organization of the shop, and we would have more intelligent employes, and get better results.

**A Manufacturer's Duty.**

I believe that corporations and manufacturers should provide for their employes such tuition, and although it might be somewhat of a burden on the smaller establishments, yet I believe Government assistance could be made available.

Of course this perhaps would not cover all the ground, but it would be a means of spreading a technical and in-

dustrial educational system all over the country, and would be the cheapest and most rapid way in which to get it started.

### Government Technical and Industrial Schools.

Then the government should establish thoroughly well equipped technical and industrial schools in the larger centres to give instruction to those who desire it in all the important industries of the country. Any young man who is capable, and wishes a high education, could attend one of these schools, if he so desired, after receiving his practical and industrial training locally. The Government could issue scholarships for competition among those desiring to attend one of these schools.

It would be a great incentive to our boys and young men, and would tend to a general betterment of their education.

A short course of this kind would not take a young man away as long from his practical work as would a four years' course at the university, for in a four years' course he would find so many changes that he would require to go over a great deal of ground again.

One of the difficulties in starting industrial classes of this nature would be that perhaps in the smaller establishments they would not have competent teachers. In the larger establishments there would be very little difficulty, but here is where the government might step in again with available aid, that is, by having a number of trained teachers in each district who could cover a certain area and go from place to place different days or evenings of the week.

Our own Provincial Government has made a commendable start in the matter of industrial classes, and while some have criticised these and say they are practically night classes, yet I consider they have made a splendid start, and where it is found there is a lack of teachers, they should put on a few to cover a certain area as suggested.

Industrial classes, which have just been commenced in Ontario, have been very much needed and the government should give them every encouragement and assistance, as it is the first successful start which will tend to develop them as they should be developed. It should be non-political as far as possible. If left entirely to our educational department things are apt to drift too much into academic teaching, and the desired practical results will not be obtained. My idea would be to hand this particular branch over to a commission of two or three men who would be entirely responsible for its being properly carried out. They would find plenty of work, and if we got the right men who were interested in this subject, it would be a great blessing to our country.

### Factors of Success.

In conclusion I would say that the success of these classes not only depends upon the government, but largely upon the individuals of the locality in which they are established. Men who are looking after them should have their work at heart, and be earnest in their endeavors to give the very best education to those seeking it, and if we combine the practical, technical and industrial training of our boys and young men, we should have the best average mechanic and workman, who will meet all requirements of these times of rapid progress and development, and we will, I believe, solve labor problems to a great extent.

My idea in coming here to-night was that after placing these few points before you, we might have a discussion on the matter, which I believe would bring out more points than I have already touched upon, and be beneficial to all of us.

### G.T.R. Classes, Stratford.

At Stratford in the Grand Trunk Railway shops we have 117 apprentices who attend classes two nights a week, and on an average we do not have more than two absent, and that is only when they obtain leave of absence, or through sickness. In regard to our industrial classes which are held on the same night, we have an average attendance of about 170 students. At the latter classes we found that we could not accommodate all who desired to attend, not having sufficient teaching staff, but we are in hopes during next year, with the start we have been able to make, that we will be able to accommodate all who may desire to come.

## C. P. R. BRIDGE, LACHINE, P. Q.

The Foundation Company which has been at work since the month of July, 1910, enlarging the piers of the Canadian Pacific Railway bridge over the St. Lawrence river from Highlands to Caughnawaga, has completed that important undertaking, and the superstructure which is being put up by the Dominion Bridge Company, Montreal, will also be completed early in the coming year.

## INDUSTRIAL ACCIDENTS.

Ninety-five fatal and one hundred and ninety-one serious injuries to workpeople were reported to the Department of Labor during November. The record is considerably more favorable than that of the preceding month or that of the same month last year. In October there were 344 accidents, fatal and non-fatal, and in November, 1910, there were 407. The chief accident during the month was the foundering of the schooner Antigua, off St. Martin's River in the Gulf of St. Lawrence, when the captain and eleven sailors were drowned. There were eleven killed in the railway service, eleven in the agricultural pursuits and twelve among unskilled laborers. The largest number of non-fatal accidents occurred in the metal trades, namely, forty-five, but the twenty-three non-fatal accidents reported in the railway service were of a more serious character.

## C.P.R. APPRENTICE SCHOLARSHIPS

The annual presentation of scholarships to the C.P.R. railway apprentices at the Winnipeg shops took place on December 22 last. These scholarships, five in number, are awarded annually upon the result of the examination based on the year's work. As is, perhaps, generally known, the C. P. R. has instituted an apprentices' instruction department, which is at present under the charge of E. E. Bailey as supervisor. In the unavoidable absence of W. E. Woodhouse, superintendent, Mr. Nield, the general locomotive foreman, presided at the meeting in the instruction room, where nearly 100 apprentices were gathered.

After some congratulatory remarks upon the work of the apprentices and that of Mr. Bailey, the supervisor, the chairman announced the result of the examination, the first eight on the list being as follows:—L. Woodhouse, P. Prior, A. Cuthbert, N. Williamson, J. Kenyon, J. McGregor, J. Brophy, H. Edwards.

L. Woodhouse, being occupied with other studies, stood out, while Cuthbert and Williamson, having previously won similar scholarships, were not again eligible. Prior, Kenyon, McGregor, Brophy and Edwards, therefore, become this year's winners.

Before the close of the proceedings, E. E. Bailey was the recipient of a presentation in the shape of a $20 gold piece in a suitable case, the gift of his pupils, together with a brief, but appreciative testimonial of their gratitude for his care on their behalf. After Mr. Bailey had suitably responded, the meeting broke up.

L. Woodhouse (son of the superintendent of the shops), Prior and Edwards, being all junior boys, makes their performance all the more creditable.

# The Plant of The Canada Forge Co., Ltd., Welland, Ont.

By J. H. Williams*

*A plant for the production and supply of heavy forgings is a prime necessity in every large engineering and industrial district, and the foresight which determined the establishment of the Canada Forge Co., has been amply justified. Growth of business, and extension developments in buildings and equipment to meet it, have been the reward and work of the management, and although, even now, the claim of being considered among the Dominion's leading industries is justifiable, we look for, within the next few years, a further strengthening of its cords and stretching of its stakes.*

THE CANADA FORGE CO., LTD., have been established at Welland, Ont., for the past five years, during which time they have built up a reputation for high quality forgings in steel and iron. The plant, consisting of forge and blacksmiths' departments, together with a well equipped machine shop, is situated on five acres of land adjacent to the Grand Trunk Railway tracks. Raw material, in the form of ingots, billets, flats, squares, etc., is received in the yard at the south end of the plant and unloaded from the cars by a derrick, for storage until required. A truck, running on an industrial railway, which forms part of an extensive system, conveys the stock from the yard to the forge shop.

**Forge and Blacksmiths' Shops.**

The forge and blacksmith departments are in one building, which covers an area of 140 by 50 feet. For blacksmith work, there are 5 smith's fires, and a 2,000-lb. single frame steam hammer served by 2 jib cranes. The stock is heated in a 72 x 48-inch coal-fired furnace, the latter being equipped with a steam-driven automatic stoker. The products of this department consist of general heavy blacksmith work, dredge and steam shovel dipper teeth, rings of all sizes, etc. In the forge, heavy pieces such as crank shafts, connecting rods, crank pins, gear blanks, axles, etc., are turned out, special attention being given to marine and locomotive requirements.

In order to better cope with large work, a 500-ton hydraulic forging press is now being installed. This massive tool works under a water pressure of 3,000 pounds per square inch. The pump for operating is of the horizontal single acting three-throw type, with plungers 1 9-16 inches diameter by 15¾ inches stroke. It is driven through direct gearing by an 85 h.p. A. C. motor. The accumulator ram is 9 13-16 inches diameter, and the stroke 12 feet. This press will be served by two jib cranes and two coal-heated furnaces fitted with automatic stokers. Forgings will be produced up to 30 inches diameter and 30,000 pounds weight. A third furnace serves a 2,500-pound double frame hammer. Waste heat from the furnaces raises steam for the hammers in two return tubular boilers, the feed water for which is taken care of by two 5¼, 3½, 5-inch horizontal duplex pumps, and feed water heaters.

Blast for the furnaces is supplied by two blowers; one being belt-driven and operated by a 10 h.p. A. C. motor, and the other direct connected to a 25 h.p. A. C. motor. The forge is equipped with an annealing pit 15 feet long by 6 feet wide, wherein all high-carbon forgings are annealed and heat treated.

**Machine Shop.**

The machine shop is separate from the forge, material from the latter being conveyed by a 5-ton electric crane running on an overhead mono-rail track connecting the two departments. Although in a plant of this description, machining consists for the most part of rough turning, slotting and planing, there is here notwithstanding, every facility for the performance of finely finished work when called for. This shop is in three bays, and covers an area of 100 by 60 feet. The machine tools are all of the most modern description, and include the following: Two

*Associate editor, Toronto.

Canada Forge Co. Machine shop, looking south.

heavy duty lathes, equipped with direct-geared motor drive to patent heads, swinging 27 and 30 inches, and taking 8 and 18 feet between centres respectively. The 30-inch lathe is used chiefly for turning large crank shafts: A 36-inch cone-driven lathe taking 8 feet between centres; a 36 by 36-inch by 15 feet planer; a 42-inch heavy forge lathe, triple geared, with 16-foot bed; a 16-lathe with 35 feet centres; an 18-inch tool room lathe, on which bolts and nuts are made and general repairs are handled; a cylindrical grinder 20 by 96 inches, used for finish-grinding crank shafts, street railway axles, etc., and driven by a 20 h.p. A. C. motor, embrace and give the reader an idea of prominent features of the works machine tool equipment.

small electric drill. The latter is mounted on the top of a large square threaded screw passing through the bed of the machine, so that the height of the drill can be adjusted to suit various diameters of shafts. After being rough-turned, the forgings are cut off to length on a 31-inch belt-driven cold saw. For cutting out crank throws, a motor-driven cold saw with two 30-inch blades

Canada Forge Co. General View of Plant.

inch slotter with special tool holder, which enables two outside cheeks of a crank to be slotted at one operation, the tool holder consisting of a steel block with checkered face, against which, the slotter tools of square section, are clamped with studs and straps. A 36-inch drill press; a 36-inch shafting

Mention must be made of an ingenious centering machine designed by the company, and to which all forgings for turning are first taken. The shaft to be centered is supported on anti-friction disks in the usual way, and the centering is done by a combined drill and countersink mounted in the spindle of a

is installed. Both saws have inserted teeth of high-speed steel.

The officials of the Company are:—Thomas J. Dillon, president; John L. Emerson, vice-president; Frank C. Hesch, secretary-treasurer, and at present, a force of 40 ment are kept fully employed.

Canada Forge Co. Machine shop, looking north.

# DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

### BROACHING MACHINE.

THE description and illustration refers to an improved Broaching Machine manufactured by the J. N. Lapointe Co., Marlboro, Mass. The frame consists of two parts, the bed being mounted on a base, and the capacity of the mechanism embraces from the smallest to the heaviest broaching practicable. The pulling apparatus includes a sliding head, pulled by a 2¾ inch screw passing through the hubs of the main gear, in which a special composition nut is inserted, for instantaneous removal as replacement requires.

In order to overcome the friction to which these machines have been subject when the load is applied, a large ball bearing thrust is fitted. A two-speed arrangement is provided, the change of speed being obtained by a sliding gear connected direct to the driving gears. This particular feature will be found advantageous in accommodating various classes of work. The machine has a positive geared drive and return; its driving mechanism being of the simplest possible type, and similar to that of a planer having one tight and two loose pulleys. A large tube attached to the rear end of the machine forms a protection to the screw against dust accumulated by the belts. Under the front end are two lugs to which a special supporting table may be fastened by means of screws.

The driving wheels run in a greased chamber, the necessity for oiling them being thereby eliminated. Due to the fact that neither pins nor a positive clutch enter into the driving of this machine, it being simply a question of belts shifting on tight and loose pulleys, any desired speed is obtainable without risk of injury. The pulley power has been demonstrated by a series of severe tests, and as an example it may be mentioned that 1½ inch holes have been most successfully broached on steel castings, 15 inches long. An automatic oil pump, for flooding the work with oil while being broached, and a countershaft complete, form part of the inclusive outfit.

Improved Broaching Machine.

### SINGLE MOTOR SELF-PROPELLING CRANE.

THE accompanying illustrations show a self-propelling single motor railroad crane, which is, at once, simple, economical and efficient for the lighter operations required of this class of machinery. Because of these advantages, it is rapidly finding a place in the equipment of factories and yards which

Fig. 1 The Browning Engineering Co. No. 4 Four-wheel Locomotive Crane.

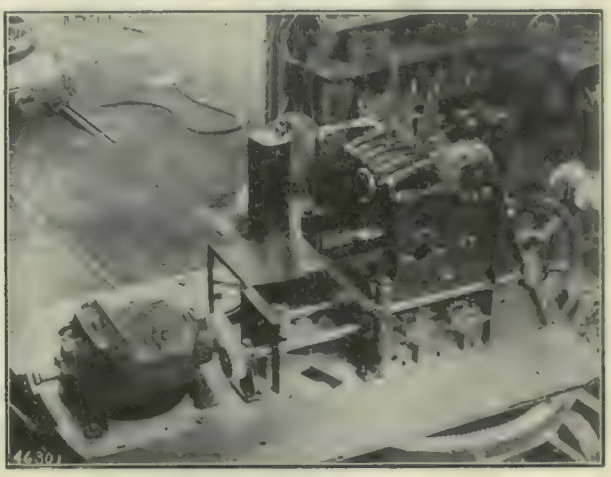


Fig. 2 Motor Connections, etc., No. 4 Four-wheel Locomotive Crane.

have only a limited use for cranes and hoisting apparatus generally.

The machine shown in Fig. 1 is known as the Browning Engineering Company's standard No. 4, four wheel locomotive crane. It is operated as a crane and propelled by a motor, under the control of one man. It has a maximum lifting capacity of 15 tons at ten feet radius and 2½ tons at forty feet radius. The working weight is approximately thirty-five tons. The draw bar pull of about 7,600 pounds enables it to handle six or seven cars on a level track. The motor, known as Type MT. No. 2, is built specially for crane service. It has a heavy frame split horizontally so that all the parts are easily accessible. The shafts are extra large and strong, and the area of the commutating surface ample for good commutation. The current density in the brushes is low. High starting torque and low fly wheel effect permit of quick starting, stopping and reversing as required by the particular service. The motor shown is rated at 50 horsepower, 220 volts and 470 revolutions per minute.

Fig. 2 gives a detail view of the motor connections and the mechanism in general. Standard reversing drum type Westinghouse controller and grid resisters are used for controlling the motor.

## REMOVABLE SPLIT RIM SPROCKET.

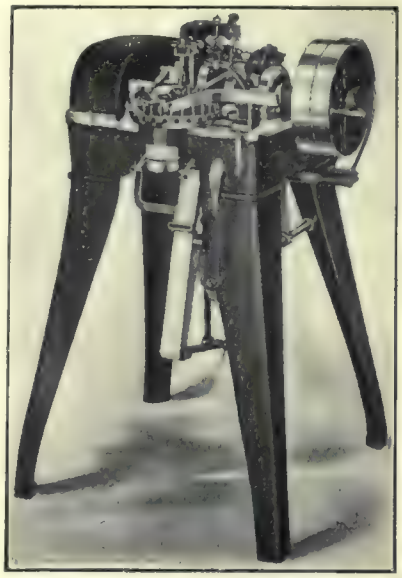
THE accompanying cuts show the Yankee Patent Removable Split Rim Sprocket, a recent development. The body is shown solid with set screw attachment, but is also made split when required. The drive on the rim is borne by the solid lugs, the bolt being used merely to keep the various parts in position.

The Yankee is intended for heavy service, where wear, due to dust and grit conditions, is excessive, such as in cement mills, ore, coal or ash elevators. A prominent feature of the new device is its economy, for, when the rim wears down, it can be replaced at about one-third the cost of a new wheel. Again, it is not necessary to remove the sprocket from the shaft, the change of rim being accomplished in place.

The A. M. Ellicott Co., 301 St. James St., Montreal, sole owners of the Canadian patents, carry a full line of sprockets together with spare rims to suit all ordinary sizes of link and roller chains.

## A CARAMEL WRAPPING MACHINE.

THE Holden-Morgan Co., 50 Pearl St., Toronto, manufacturers of special machinery of all kinds, have recently completed five ingenious machines for wrapping caramels, one of which is herewith illustrated. Fellows & Hopkins, Middletown, N.Y., who build them in the United States, supplied the designs.



Caramel Wrapper. The Holden-Morgan Co.,

The operation of the machine is as follows:—The material for the caramels is first rolled to the correct thickness in bars or slabs 5 ft. to 6 ft. long. These go next to a scoring machine, and are cut into strips of the proper width to fit the chute seen at the front, near the pulley. Two girls, one to feed and one to pack the wrapped caramels, are in attendance. The machine stands between two tables, the total floor space occupied, inclusive of tables, being about 4 feet by 12 feet. The candy is brought from the scoring machine to the table on the right of the wrapper and is fed into the chute already mentioned. When starting up, it is of course necessary to push the candy into the whole length of the chute so that it be engaged by the projecting pieces on the rotary table. It is then drawn in automatically. This rotary table, or rotary cutting plate, as it is more correctly called, is fitted with twenty-four knives operated by an eccentric pressure plate below. The candy is delivered to the cutting plate at the front and travels round to the back, by which time it is completely cut through. In the meantime, the wrapping paper has been cut off from the continuous roll below the machine and together with the caramel is pushed into the grooved rim of the wrapping wheel at the back of the machine. Three more movements complete the wrapping, after which the caramel passes down a second chute to the packing table. The whole operation takes but a fraction of a second, the machine being guaranteed to satisfactorily wrap 240 caramels per minute. The power required is about 1-10 horse power

Yankee Patent Removable Split Rim Sprocket, Assembled.

Yankee Patent Removable Split Rim Sprocket, Knock-down.

There is a large amount of fine delicate work in a machine of this kind, and it speaks well for the equipment and reputation of the Holden-Morgan Co., that they should have been entrusted with the order.

## DISC GRINDING IN THE PATTERN SHOP.

THE disc grinder is coming to be recognized as a valuable adjunct to the up-to-date pattern shop, not only because it is a great time saver, but also on account of the high degree of accuracy obtainable by its use.

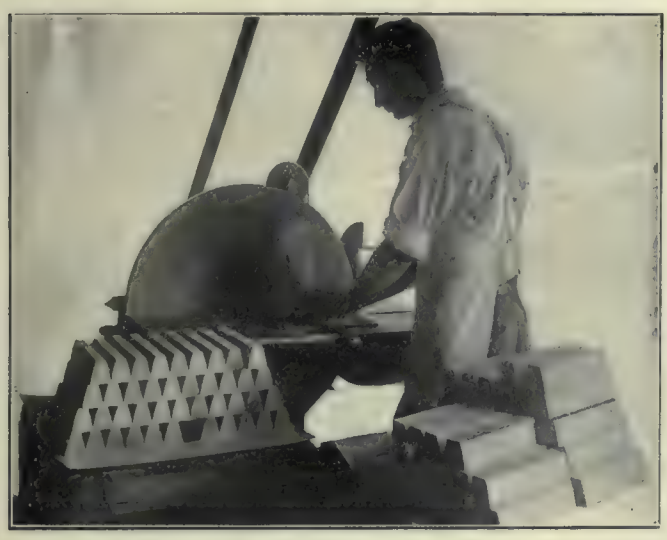


Fig. 2.—Gardner Pattern-makers' Disc Grinder

In keeping with their reputation as prominent manufacturers of disc grinders for all purposes, the Gardner Machine Co., Beloit, Wisconsin, a short time ago, added to their line a grinder especially adapted to pattern-making. This machine is made in several styles and sizes, fig. 1 showing the No. 18 grinder. This has two 30-inch discs, which run at 756 r.p.m., and are driven by a 5-inch belt. One of the principal features is the universal work-table, the weight of which is supported by a counter-balance within the base of the machine through the medium of a cable passing over a grooved pulley at the top. The table may be tilted to any angle with the face of the wheel, a graduated segment enabling the angle to be accurately determined. The tilting axis is so designed that the inside edge of the work-table always remains close to the face of the wheel, regardless of its angular or lateral position. Attached to the left-hand table, fig. 1, may be seen a universal angle gauge. This gauge or protractor head is a great convenience for squaring pieces, and in producing angles and draught. It is graduated from zero to forty-five degrees in either direction. By the use of these graduations in conjunction with those on the head of the table, any combination of angles may be quickly and accurately obtained.

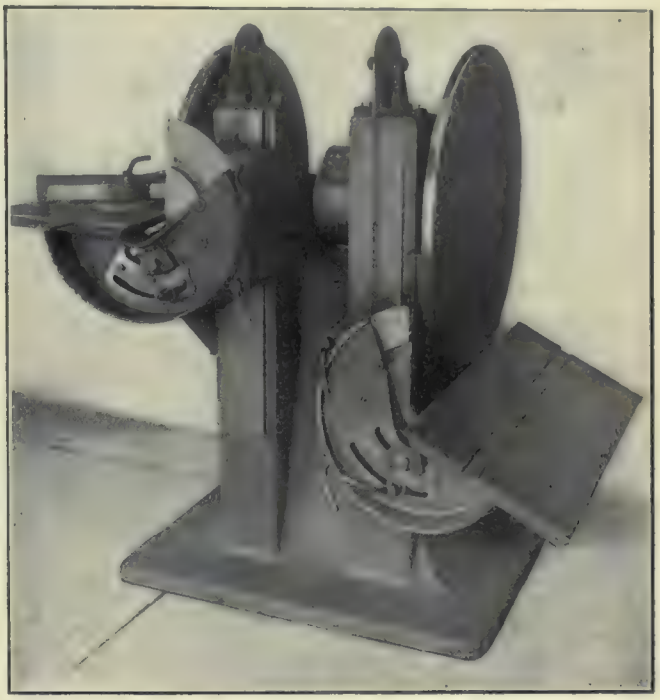


Fig. 1.—Gardner Pattern-makers' Disc Grinder

The guide bar of this attachment is adjustable, so that when the table is tilted or the gauge set to an angle, the bar may be moved to right or left, thus

Fig. 3.—Gardner Pattern-makers' Disc Grinder

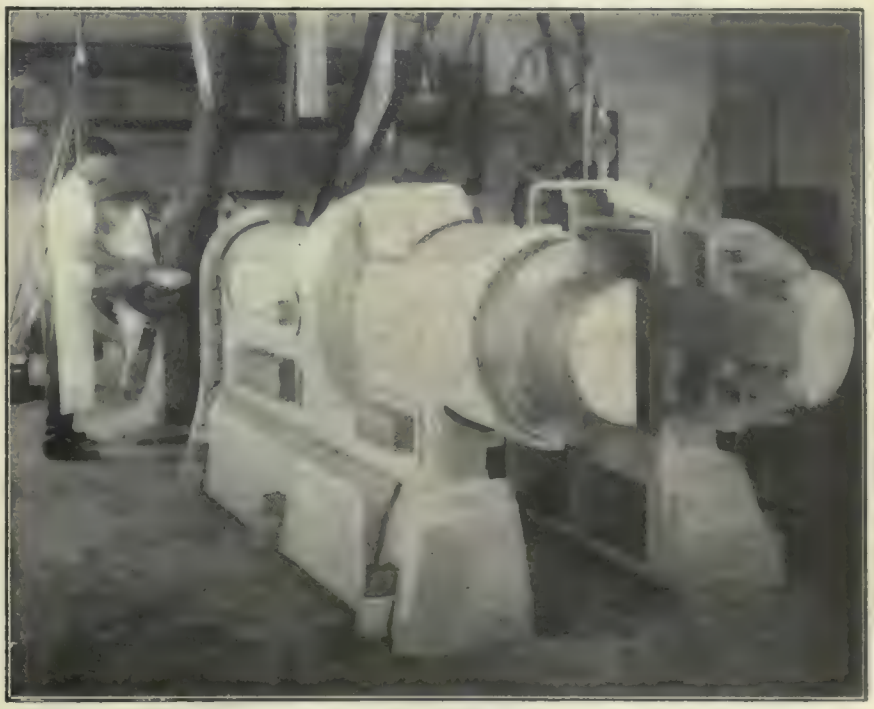


Fig. 4—Gardner Pattern-makers' Disc Grinder

keeping one end always close to the wheel. When adjusted, a hand nut locks it in the required position and at the proper angle. Another attachment supplied with the machine is the circular core-print gauge for producing round or curved surfaces. The work is pivoted on a pin driven in at the proper radius, and swung against the wheel. An adjustable stop screw regulates the amount of stock removed and also makes it practicable to produce duplicate work. Tilting the table, of course, puts a taper on the work.

Fig. 2 shows a practical adaptation of this attachment to the making of teeth for a gear pattern. The operator is seen producing the curve of the teeth. The blocks, 8 inches long by 2½ inches wide by 3 inches high, were first made parallel on the universal duplicating gauge—another attachment supplied with the grinder,—and then squared up on the ends by using the universal angle gauge. A simple wooden fixture was used for holding the blocks, and by means of the circular coreprint gauge, the fixture and block were swung against the wheel. The table was tilted one-half degree to produce the required draught. The stop screw enabled all the 96 teeth to be made exact duplicates, and it is estimated that the work was done in one-tenth of the time it would have taken by the old method. In addition, it was done more accurately and with better finish.

Fig. 3 shows the completed gear pattern. Most of the machine work on this was done on the pattern-maker's disc grinder; all the segments used in the outside rim being ground parallel to size and glued-up on the face plate before being put in. All pieces in the spokes were made parallel and squared up on the grinder before the glueing operation, and the round hubs, plates and coreprints ground with taper by use of the circular coreprint gauge. From the foregoing it will be seen that hand or machine planing or trimmer work on the pattern was entirely eliminated.

Fig. 4 shows the pattern for the front, or cylinder half, of a 150 h.p. gas engine, a large portion of the work on which was done on a disc grinder. Thus, the staves forming the cylinder barrel and coreprints were all gotten up on the grinder, resulting in perfect glue joints throughout, without the use of a plane or other tool or machine.

Knots, cross grains, end grains, hard or soft woods, and even projecting nails or screws can be worked without difficulty, and the grinder may also be used on metal pattern work. When renewing the abrasive discs, it is not necessary to first remove the wheels from the spindle, since the Gardner Machine Co. supply a special cement for attachment, thus doing away with the necessity for a wheel press.

## THE GOSPEL OF EFFICIENCY.

IF we miss the right way to universal happiness and prosperity in the twentieth century, it will not be for the want of teachers and preachers. From the moment of our birth (or even earlier) the best method of handling us is described at great length in print, and if we had time to read thereafter all that is written concerning Education, Success in Business, Personal Hygiene and Applied Psychology, we should no doubt escape all the ills that flesh is heir to and only decide to die when thoroughly bored with things always going right and never wrong.

This same efficiency or allrightness is universally desired by those responsible for armies and navies, factories and mines, and publicly and privately organized effort of any kind. Nothing is easier than to look round and see that some one is apparently shirking instead of working, or that two men are pulling against each other, back to back, instead of shoulder to shoulder, or that there are millions wrongly fed or badly housed or imperfectly trained. In fact, any fanatic prophet of efficiency must find it difficult to avoid the temptation to throw up his hands in despair and incontinently drown himself.

### A World of Waste.

Wherever his penetrating incandescent glance may fall, behold, it is all wasteful. The walrus and the carpenter wept to see such quantities of sand—unused. Nothing is easier than to observe such phenomena of natural and human extravagance and neglect, and to make sententious remarks about it. Yet nothing is harder than to deliver spoken or written advice that is not bald, flat, commonplace and unconvincing. Under sublimely enlightened general management with a free hand it is possible that the world's work could be done far better and with much less trouble, but it is only the dreamers—themselves atrociously inefficient—who cherish such thoughts. The hard-headed practical man who gets things done is only attracted by the gospel of efficiency in so far as it may enable him to get the better of his competitors in money making. He would dismiss any more general appeal with the very plausible theory that you cannot get much efficiency except under the spur of self-interest.

### Failure's Eplanation.

It is most curious that the people who preach to us are not usually those who are accomplished practicians. Great generals and admirals do not write text-books on tactics, neither do millionaires tell us how to make fortunes. They pretend to do so sometimes in newspaper interviews, but the really interesting advice comes from those who have been through the bankruptcy court. Nothing indeed is so helplul to the young and ambitious as the candid record of failure, intelligently explained. In business especially, the most useful thing to know is what not to do. General advice of this negative character may be really serviceable; but for the positive purpose there is nothing available except the native sense and wisdom of the hero himself. Many men established in a comfortable way of business advance steadily by mere industry and scrupulous attention to a set of rules that could be written on a half sheet of note paper, while there are many failures who have fallen just because their much superior intellect has not been yoked to the proverbial prudence of the ages.

### Over-drilling.

There are foods of high nutritive value according to analysis, which require such an expenditure of energy in their digestion that the more the consumer eats the sooner is he likely to die of starvation. Similarly, the conscientious disciple of efficiency may pay so much attention to the admired rules and machinery prescribed that he may find himself short of time and energy for doing the real work of the day. There are men who become the slaves of their filing systems, or who worry themselves into ill-health over trivial faults in office routine. Periodic relaxation is quite as important as concentrated application.

While, on the whole, it may be true that most men are not reaching their maximum output of work, and that, if they were driven at their full load capacity, the results would be astonishing for a time, it is perhaps a healthier state of things that there should be this margin of potential effort left unemployed except on occasions of emergency. Over the top of efficiency is the precipice of breakdown—Electrics.

In speaking of increasing efficiencies in workshops, a prominent shop manager says that manufacturers are just beginning to resolve into first principles the various manufacturing processes of their finished products. They have yet to apply this analysis in exactness to the problem of machine efficiency in the manufacture of their products. He stated that he believed that there is a lack of knowledge of the possibilities of the most common type of machine tools in every shop; in fact there is not one shop in 10, in which the possibilities of even the engine lathe are thoroughly understood.—Ex.

# Horse Power Years vs. Kilowatt Hours: Which Pays Best?

By H. E. M. Kensit, M. Inst. E.E.

*The management of industrial enterprises, using electrical power in the manufacture of their product, will find the information contained in this article particularly valuable, showing as it does, by easily followed reasoning and calculations of a simple nature, the procedure to be adopted in discriminating between the two well-known forms of electrical power contract, so as to secure an outlay commensurate with the exacted service.*

MANY manufacturers and other power users, when making contracts for electric power, are given the option of taking it at a price per h.p. year or a price per k.w. hour. Few such persons are in a position to decide which system of rating will be cheapest, and the object of this article is to enable power users, unfamiliar with the special technical points involved, to clearly decide which plan will secure them the lowest annual cost. Taking any given schedule of prices charged by an electric power company, there are very few cases indeed in which the supply to a factory would work out to the same annual amount, when charged on the h.p. year or k.w. hour basis, and in many instances the difference in favor of one or the other would be very marked.

There are three phases of the question to consider :—

1. Where a calculation, based on conditions of work that can be foretold with a fair degree of accuracy, shows so large a margin in favor of one or other of the methods, that no probable variation in these conditions would change the result to any considerable extent.

2. Where a similar calculation shows no decided margin in favor of either system of charge.

3. Where a factory has been previously electrically operated, and records of maximum h.p. used and k.w. hours consumed have been kept for a sufficient time and with sufficient accuracy, to show closely the actual conditions of work.

### Load Factor.

The three cases will be separately discussed in detail, and as the whole solution centres mainly on "load factor," it is necessary to have a clear and exact idea what is understood by this, and how it affects the subject under consideration.

The term load factor means the ratio between the power, or more correctly, the "energy" actually used and what would have been used during the same period, if the maximum or peak load had been maintained for the whole of that period. It is, therefore, affected both by hours worked and by the relation between the maximum and average power used. In order to get reliable results, the load factor should be taken over a whole year, in order to eliminate varying results at different seasons. It should also take 365 days per year into account, and not working days only, for power, taken on the h.p. year basis, is paid for and may be used every day of the year.

Very brief consideration will show, when power is taken per h.p. year, that the more nearly what is actually used approaches the greatest amount possible to have been taken during the like period without increasing the peak load, the the cheaper does the power become in relation to useful work done, in other words, the load factor is high, and under these conditions, the h.p. year method of charge is the most favorable to the user. It is obvious that if $20 per h.p. year is paid for unlimited hours of use, it is a better bargain if the power is used for 24 hours a day, and 7 days a week, than if it is used for only 9 hours on 6 days a week. Conversely, in the case of a low load factor, where power is used only intermittently, the charge per k.w. hour is likely to be most favorable to the purchaser.

### Example of Load Factor.

To give a concrete instance of working out the load factor, suppose a factory, with motors totaling 100 h.p. installed, whose peak load over any appreciable period does not exceed this, but averages 75 h.p.; also that the daily hours of work are nine, and the working days 300 per annum. The total working hours would then be 2,700, out of a year's total of 8760. The load factor, due to average load being less than maximum, would be $100 \times \frac{75}{100} = 75\%$.

The load factor, due to actual hours being less than total possible, would be $8760 \times \frac{100}{2700} = 31\%$, and the actual load factor would equal 31 p.c. of 75 p.c.= 23p.c.

For convenience we may use the formula:—Per cent load factor=

$$\frac{\text{H.P. hours actually used} \times 100}{\text{Peak load} \times \text{total hours per year}}$$

In the present example this will be :—

$$\frac{75 \text{ H.P.} \times 2700 \text{ hours} \times 100}{100 \text{ H.P.} \times 8760 \text{ hours}} = 23\%$$

load factor.

The actual load factors obtained under working conditions with electric drives are always much less than would be anticipated from a consideration of maximum power used and hours worked. This is due to various inherent economies in the electric drive which are now fairly well understood, but which are outside the scope of this article. Electric driving lends itself to accurate measurement of the actual energy or K.W.H. used, and the maximum peak load occurring in a given period.

### Load Factors from Typical Factories.

The following list of load factors obtaining in a few typical classes of factories may be of interest. The figures as to per cent of average load to connected motor load (total rated H.P. of motors installed) are taken from a paper read by Mr. E. W. Lloyd before the National Electric Light Association, and check closely with many similar results from other sources. The annual load factor is deduced from this on the basis of a 54 hour week.

TABLE I.

| Kind of Work. | % of average load to connected motor load. | Annual load factor if operated 54 hrs. per week = 31% of full time. |
|---|---|---|
| Boiler shops | 27% | 8.4% |
| Sheet metal | 27 | 8.4 |
| Soap making | 28 | 8.7 |
| Wood working | 33 | 10.2 |
| Machine shops | 35 | 10.9 |
| Furniture | 36 | 11.2 |
| Boots and shoes | 43 | 13.3 |
| Clothing | 45 | 14.0 |
| Box making | 45 | 14.0 |
| Cotton mills | 60 | 18.6 |
| Woolen mills | 71 | 22.0 |
| Average | 41% | 12.8% |

It will be seen that the average load is only about 40% of the rated H.P. of the motors and the average annual load factor on a 54 hour week is only from 12 to 13%. Now, it is quite usual when power is sold on a H.P. year basis to fix the charge on the total rated H.P. of motors connected, and in such a case, it will be seen that the manufacturer is

often only using 12 to 13% of the power he is paying for, and entitled to use.

In other cases, instruments are installed to measure the actual peak load taken, and the charge is made on the highest reading, lasting at any one time from 5 to 30 minutes, according to the schedule of the power company. This is a much more equitable arrangement, and a specified period of even 5 minutes will be sufficient to prevent the momentary excess load, due to starting a machine, from raising the bill above that due for ordinary maximum load.

In such operations as cement-making, refrigeration, pumping, etc., in which there is a steady 24 hour load for most of the year, the annual load factor may be as high as 80 or 90%.

### Comparison of Methods of Cost Charge.—I.

We may now proceed to a comparison of the two methods of charge in some specific cases. Reckoning the alternative charges offered to be $25 per H.P. year, based on the rated H.P. of motors installed, or 2½ cents per K.W. hour, and taking first, the boiler shop (table I.) with a load factor of only 8.4%, and assuming it uses 30 H.P., then, on the H.P. year basis the charge would be:

30 H.P. at $25=$750.

For the K.W.H. basis, we must remember that the motor is rated on its output, and the charge for electricity per K.W.H. is made on the input; in other words, the power user pays for the loss in the motor. An average efficiency for motors, from 5 to 50 H.P., may be taken at 85%. One horse power = 746 watts, and 1 kilowatt = 1000 watts, so that $\text{H.P.} \times \frac{746}{1000} = \text{K.W.}$

30 H.P. output at 85% efficiency = 35.3 H.P. input, and

$$35.3 \text{ H.P.} \times \frac{746}{1000} = 26.4 \text{ K.W.}$$

The load factor of 8.4% is due to both intermittent use and varying load, but it introduces no error to assume, for the purpose of this calculation, that the plant worked at full load for very short hours. We, therefore, take the whole percentage off the hours.

$$8760 \text{ hours per year} \times \frac{8.4}{100} = 735 \text{ hours.}$$

735 hours × 26.4 K.W. = 19,400 K.W. hours.

19,400 K.W.H. at 2.5 cents = $485.

The annual saving in favor of the K.W.H. basis is therefore $265 or 35% and it would probably be safe to make the contract on that basis.

### Comparison of Methods of Cost Charge.—II.

Next take the case of the furniture factory with a load factor of 11.2%. Working this out in exactly the same way, we have:—

Annual charge on H.P. year basis=$750

Annual charge on K.W. H. basis=$650.

In this instance it will be seen that the margin is small, and a slight change in the estimated working conditions might throw the balance either way. The manufacturer, where he has the choice of two rates, should, under such circumstances, stipulate, before making a contract for a term of years, that he shall have the option of changing to the other rate after one year's trial. He can then instal his own electrical measuring instruments, and after a year's run will be in a position to decide which rate will give him the cheapest power.

### Comparison of Methods of Cost Charges.—III.

Again, take the case of the woolen mill with a 22% load factor. Worked out exactly as before, this shows:—

Annual charge on H.P. year basis=$750

Annual charge on K.W.H. basis=$1275.

Here, the margin in favor of the H.P. year basis is so large that no probable change in working conditions could turn it the other way, and, therefore, no further consideration is necessary.

To simplify the examples, only 30 H.P. has been used throughout, therefore, the totals given are small, but in the case of factories using hundreds of H.P., the annual sum involved may be large, and the question is then worthy of the most careful consideration before making a contract.

### Comparison of Methods of Cost Charge.—IV.

Lastly, take the case of a factory which has operated its own electric power plant. If records have been kept of the peak load and K.W. hours used, and of the cost of producing same, then the cost per K.W.H. is known. If it be under consideration to take supply from an outside source on a H.P. year basis, then the price, equivalent to the present cost of producing, would be:—

Price per H.P. year =

$$\frac{\text{K.W.H per annum} \times \text{cents per K.W.H.}}{\text{Peak load in H.P.} \times 100.}$$

To illustrate the foregoing points we have discussed, Table 2, follows: Assuming $25.00 as the price paid per H.P. year, based on rated output of motors installed, and that the average efficiency of the motors is 85%, then this table shows the price per K.W.H. that would be the equivalent of $25 per H.P. year at different load factors.

**TABLE 2.**

| Price Per H.P. Year | Load Factor | Equivalent Price Per K.W.H. in cents. |
|---|---|---|
| $25 | 8% | 4.06 |
| 25 | 10 | 3.24 |
| 25 | 20 | 1.08 |
| 25 | 30 | 1.62 |
| 25 | 50 | 0.65 |
| 25 | 70 | 0.46 |
| 25 | 90 | 0.36 |

## INSPECTION OF LOCOMOTIVES.

After January 1, 1912, the inspection and testing of locomotives on all the railroads under the jurisdiction of the Railway Commission of Canada will be governed by new and rigid rules which the Board has issued to every road affected.

They provide that companies are to be responsible for the general design and construction of locomotive boilers under their control; that a safe working pressure is to be fixed by the chief mechanical officer of the company or a competent mechanical engineer under his supervision; that the mechanical officer in charge, at each point where boiler work is done will be held responsible for the inspection and repair of all locomotive boilers.

It is ordered that not less than once each month, or fifteen days after inspection, a report of such inspection is to be filed with the chief operating officer of the board for each locomotive used.

In case of accident from failure of locomotive boilers or their appurtenances, resulting in serious injury or death, the company owning or operating the locomotive is required immediately to wire the board's operating officer regarding the accident and the complete list of killed and injured.

A penalty of $100 is fixed for contravention of any of the clauses in the new order.

## STEFFENS & NOLLE OPEN CANADIAN BRANCH.

Among the firms who have recently entered the Canadian markets is the large German house of Steffens & Nolle, Ltd. The head office and factory are in Berlin, Germany, where they have over a thousand employes. The firm is capitalized at $2,250,000, and their Canadian headquarters is Room 27, Beardmore Building, Montreal. They are carrying a full line of hardware, wood and metal-working machine tools, and will also handle heavy iron goods, including structural steel, sheet metal, seamless drawn tube, steel sheeting, forgings and castings. Mr. W. Steffens is manager of the Canadian branch, and Mr. R. W. Bartram, for some years purchasing agent for the Allis, Chalmers, Bullock Co., is prominently connected with the firm.

# CANADIAN MACHINERY
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## THE OUTLOOK OF 1912.

IN ITS broadest sense, the advent of this Year of Grace, 1912, may be said to presage an auspicious outlook. Notwithstanding the disturbing and distracting effects of political changes in home government and the more or less uncertainty apparent in the realm of Imperial relationships, it falls to be recorded that Canada, during the year just gone, has kept steadfastly on the even tenor of her way towards an increased and highly satisfactory development in almost every sphere to which men, mind and matter are contributory agents. The natural inclination, however, is not to dwell on past achievement, and it is well, perhaps, that it be this wise. New and important considerations, hitherto undreamt of projects and developments, discoveries of almost miraculous import and pressing social problems will, in the future each bear a part in the molding of our personal and national upbuilding, and we may not shut our eyes and stop our ears when they present themselves and voice their demands.

The industrial outlook, which in large measure is that of machinery and the mechanical arts, was never, we are safe in saying, so bright in the history of this Dominion, as we find it to-day. Men of all shades of political, administrative, civil and social opinion, in every rank and station, have expressed themselves as satisfied to the point of being optimistic, regarding Canada's agricultural and industrial near-future possibilities. The wealth uncovered has but revealed resources, by comparison, to stamp the former as a mere scratching of the ground, and who shall gainsay the prediction that for this New Year and those to follow, the mine, the blast furnace, the smelter, the foundry, the boiler shop, the forge, the rolling mill and the machine shop, will each be taxed to an increasing extent to keep pace with our individual needs and discoveries.

Questions of more than ordinary importance have already arisen from this healthfully abnormal condition, and it may here be observed that pressure, for wise decision and action upon them, is urgently felt. Prominent among these may be cited the Georgian Bay Canal, the Welland Canal, the Canadian Navy, workmen's compensation, the problems of labor, technical education, the interference of politics, mergers, trusts, etc. Beyond the sphere of the foregoing, and touching what might be termed external affairs, every citizen of this Dominion, in his capacity of being a responsible unit of a great Empire, must intelligently follow and study such momentous issues as Imperial relationships, the root cause and general effects of the recent great railway strike in England, and the certain changes which the opening up of the Panama Canal will produce on a large portion of Canadian imports and exports. Our country is off to a good start and sane, "douce" and determined men are, in a majority, exerting a firm control. As a result, not only is well regulated progress and development for the welfare of our own citizens being secured, but the confidence of sister nations from a trade and investment point of view is also being clearly manifested.

In manufacturing circles, the past year witnessed the consummation of many mergers and the growth and practice of various propagandas for the more efficient and, therefore, economical output of relative products. Concerning mergers, we are not disposed to credit those whose inspiration conceived them, as being imbued with the highest ideals and most patriotic motives, nor do we consider their flotation in such evidently wholesale fashion as an altogether public or national benefit proceeding. Consolidation, under stress of competition, may and does sometimes become necessary, but schemes whereby our industries are made financial footballs, do not assuredly tend to that stability of employment on which hinges the employes' greatest efficiency, and consequently our National ability to successfully hold a prominent place in the markets of the world. The unifying and reduction of administration expenses is, of course, a reasonable excuse for such a line of action, but we are not disposed to believe that the advantage so gained is in any way commensurate with the widespread and generally deleterious effects produced. A cessation of the merger fever has been distinctly noticeable of late, due no doubt to some more or less unsuccessful realizations, and its resumption should be so carefully considered in the coming time, that nothing short of strict necessity will revive this dangerous plaything. A larger pride, with regard to a high place for excellence of product among the old established manufacturing nations of the world, and a lesser concern for stock market effects, is an absolutely undeniable requirement of industrial greatness and labor content of this or any other country.

Notwithstanding civic jealousies as evidenced in the upbuilding of the leading cities of the Dominion, in spite of the vested interests opposed, and independent of their influence in catching votes by either political party, there is little room for doubt that the Welland and Georgian Bay Canal Schemes will go forward to successful completion at no distant date, and present indications are that requirements will be ahead of the date of service available.

Problems, arising from the demands of organized labor, touching technical and industrial education and training, workmen's compensation, etc., are, so to speak, ripening for solution, and will demand wisely considerate handling together with a mutual sacrifice of cherished, yet mayhap, untenable principles.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## MOLDING A BED PLATE 19 FEET LONG.

By John H. Eastham.

MOST jobbing molders, who have been employed in small foundries where heavy work is done, are aware of the difficulties encountered in the successful handling of large pieces. Insufficient lifting facilities, coupled with lack of working space and bad light, put the foreman up against problems which take not a little solving before a casting is safely in the machine shop or shipped to the outside customer.

In a shop, which could not have been laid out worse, even by intent, the order was received for an oil engine bedplate measuring 19 feet over all; the general design of the pattern being shown in plan and side views, Fig. 1. We had a wheezy, old, hand-operated traveler, which, when new in a distant past, had been certified to carry three tons; also, a jib crane, hand operated, and which would carry about seven tons, if all the men in the shop and neighborhood crowded around to hoist, and to "pull her round" by the long chain attached to the end of the jib for this purpose. We had not a cope flask large enough to cover the job, and lift out the inside in the usual way. Again, if we had rammed-up two copes with a sloping parting between, we would have been prevented by the shape of the foundry from turning them over to receive the necessary finishing.

After a little consideration, a plate to lift away the outside, as shown at Fig. 2, was cast; a hole six inches below the full depth of the pattern being afterwards dug out. A cinder bottom was laid over its full area, and a hard bed swept off four inches above the cinders. The pattern was laid on this, and a parting made around the outside; the plate already mentioned being lowered to place, over and embracing the pattern. After ramming the first outside course, 4 ingates, of sufficient length to clear the ends of the plate by several inches, were bedded in, two on each end of the pattern. The ramming of both cheek and core were proceeded with simultaneously, the skeleton design of the pattern making this possible. Another advantage consisted in the pattern being kept to shape without packing or wedging. The core being now securely staked, the corners suitably ironed, and the cheek plate rammed-up to its full depth, a parting was then made, and the lower or long end of the pattern and joint covered with stiff loam; the prodded plate "A," Fig. 3, being stamped on

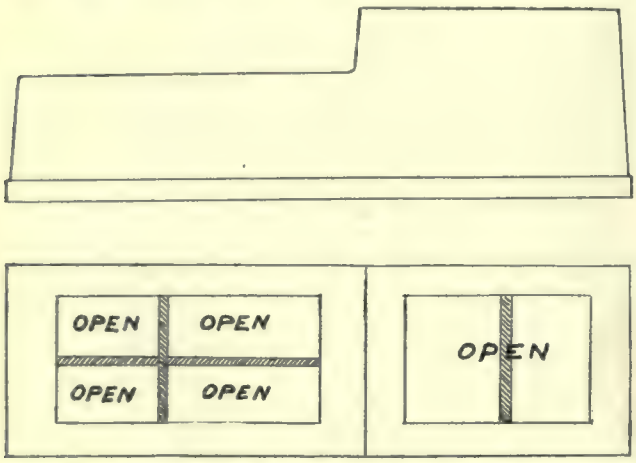



Fig. 1.—Molding a 19 ft. Bed-Plate.

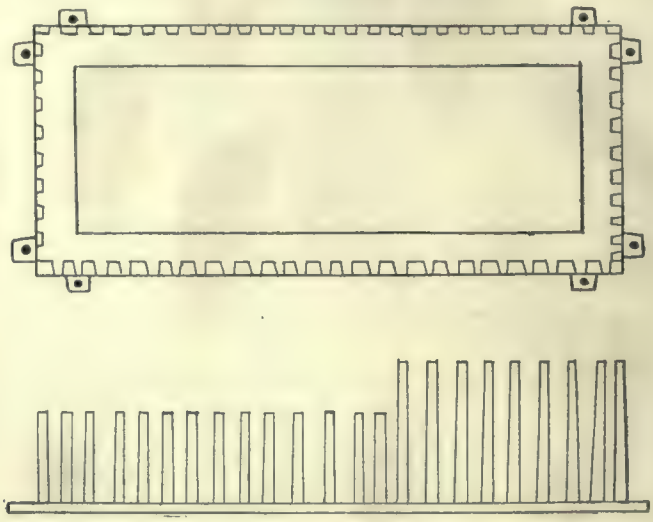


Fig. 2.—Molding a 19 ft. Bed-Plate.

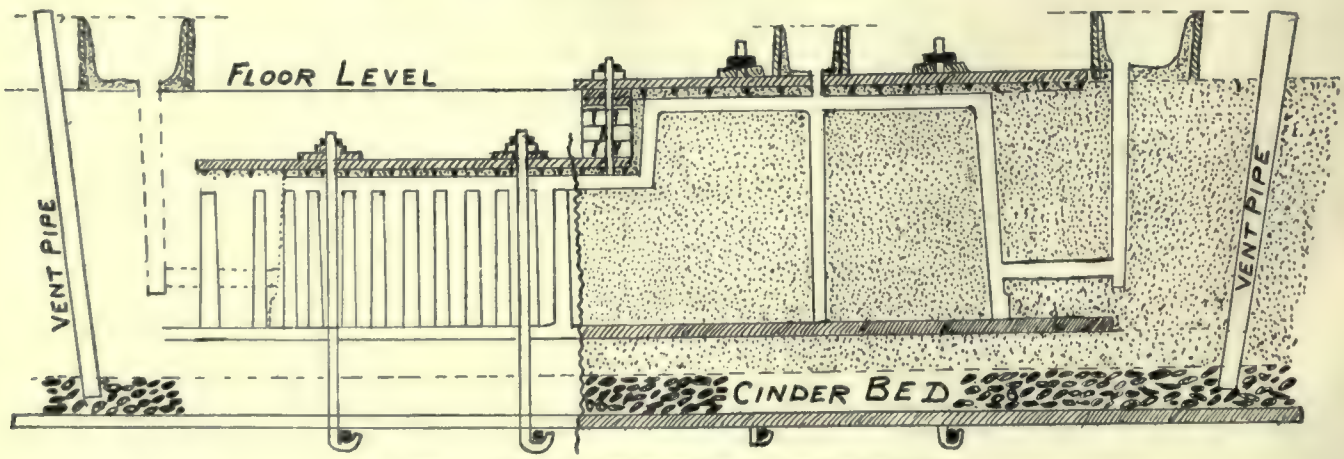



Fig. 4.—Molding a 19 ft. Bed-Plate—the Finished Mold.

this. After the upright face of the pedestal stand or high end of the pattern was jointed and the sides lined-up with wet parting sand, a course of brickwork was built on the plate "A," to the full height of the pattern, and stuffed-in with loam; the narrow plate, "B," Fig. 3, being laid on this and bolted to the plate "A" by the eyes and lugs indicated The top joint was next covered with parting sand; one inch of loam being spread over the whole top surface, and the crown plate "C" Fig. 3, stamped to place. In order to give the loam plates and brickwork time to "set," the outside of the cheek plate was dug away its full depth to allow of removal, and

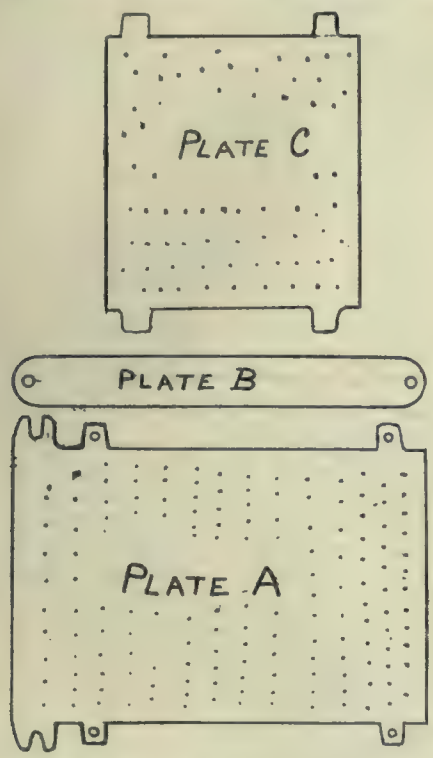



Fig. 3.—Molding a 19 ft. Bed-Plate.

the cheek staked at its four corners. The crown plate "C" was hoisted from the pattern, turned over, daubed-up where needed, and placed on the stove car; the process being repeated in the case of plates A, B, and brickwork combined. With the pattern seat strickled out to its correct thickness, and the core vented all over, down to the cinder bed, the cheek was hoisted away, and lowered on logs a little above the foundry floor, to permit the necessary finishing. The pattern was then drawn, the core finished, together with the jagged lift around the edge of the cheek plate, the company's nameplate stamped on each side of the mold, the whole plumbago blackened, and the cheek plate lowered again to place. The four ingates having been drawn outwards, and the upright runner pins placed exactly to their ends, the base of each runner was packed up by cake cores to avoid "ramming in."

The cope plate A with brickwork and plate B attached, and previously finished and blackwashed, was now applied, and being found accurate, the crown plate C was lowered to place. The whole mold was next bolted down to a permanent grating in the floor, Fig. 4, the outside rammed-up to floor level, the runner and riser boxes lined up, and the job successfully cast. A repeat order two weeks later, more than justified the small outlay on rigging.

## THE LAYOUT AND PATTERNMAKING OF GEARS.

D. O. Barrett, B.Sc.

THE following article is not intended as a scientific treatise on the subject of gearing, but is for the benefit of the practical man, giving the details of laying-out the shape of the tooth and the method of making the patterns, so that the shape of the tooth shall be accurately retained. A general knowledge of the terms common to the subject is presupposed.

The methods here shown were used by the author in the manufacture of gears for several traction engines and commend themselves because of their low first cost, and also because each tooth is an exact duplicate of the others; an impossibility where the shapes are worked out by hand.

### Laying-Out the Tooth Curve.

Fig. 1 shows the method of laying out the tooth curve. This is obtained by using Grant's Odontograph. The accompanying table was taken from the catalog of the Grant Gear Co. and gives the necessary constants for the various numbers of teeth. To make the method more concrete, a gear of 30 teeth and 2 inch circular pitch has been chosen. The pitch diameter for this will be $2 \times 30 \div 3.1416$ or 19.098 inches. The pitch circle may now be laid out and the teeth stepped off. To allow clearance

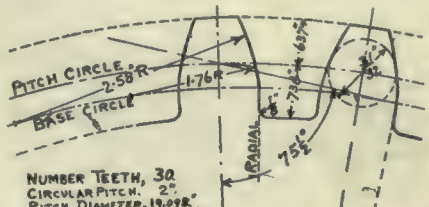



Fig. 1.—Method of laying-out tooth curve.

between the teeth, the thickness of the tooth itself was made 31-32 inches, which would give a clearance of 1-16 inches between the teeth of the intermeshing gears.

The next values to be obtained are the height above the pitch circle and the depth below, spoken of as the addendum and the dedendum, respectively. The addendum is equal to the circular pitch multiplied by 0.3183, or, in this case, equals $2 \times 0.3183 = 0.637$ inches. Now the dedendum is equal to the addendum plus the clearance at the bottom of the tooth, this being 0.05 of the circular pitch so that the dedendum is equal to the circular pitch multiplied by 0.3683 or, $2 \times 0.3683 = 0.736$. The outside diameter of the gear will be the pitch diameter plus twice the addendum or $19.098 + 2 \times 0.637 = 20.372$. The diameter of the blank or the diameter at the bottom of the tooth will be the pitch diameter less twice the dedendum or $19.098 - 2 \times 0.736 = 17.626$ This diameter at the bottom of the tooth will be used when the blank on which the teeth are fastened is turned up.

The circles for the top and bottom of the teeth should now be drawn in their proper positions. From the point where one of the tooth centre lines intersects the pitch circle draw a line making an angle of 75½ degrees to the centre line or making an angle of 14½ degrees to

| Number of Teeth | Multiply by Circ. Pitch. | |
|---|---|---|
| | Face Rads. | Flank Rads. |
| 10 | .73 | .22 |
| 11 | .76 | .27 |
| 12 | .80 | .31 |
| 13 | .83 | .34 |
| 14 | .87 | .39 |
| 15 | .90 | .43 |
| 16 | .93 | .47 |
| 17 | .96 | .50 |
| 18 | .99 | .54 |
| 19 | 1.03 | .57 |
| 20 | 1.06 | .60 |
| 21 | 1.09 | .63 |
| 22 | 1.11 | .66 |
| 23 | 1.13 | .69 |
| 24 | 1.16 | .71 |
| 25 | 1.18 | .74 |
| 26 | 1.20 | .77 |
| 27 | 1.23 | .80 |
| 28 | 1.25 | .82 |
| 29 | 1.27 | .85 |
| 30 | 1.29 | .88 |
| 31 | 1.31 | .91 |
| 32 | 1.34 | .93 |
| 33 | 1.36 | .96 |
| 34 | 1.38 | .99 |
| 35 | 1.39 | 1.01 |
| 36 | 1.41 | 1.03 |
| 37-40 | 1.34 | |
| 41-45 | 1.48 | |
| 46-51 | 1.61 | |
| 52-60 | 1.83 | |
| 61-70 | 2.07 | |
| 71-90 | 2.46 | |
| 91-120 | 3.11 | |
| 121-180 | 4.26 | |
| 181-360 | 6.88 | |

Grant's Odontograph.

the tangent at that point. This line represents the line of pressure or the angle at which the tooth of one gear presses against the corresponding tooth of its mate. For this reason this style of tooth is called the 14½ degree involute

lute, the curve being of the involute form. A circle should now be drawn just touching this 14½ degree line or, in other words, just tangent to it. This circle is called the base circle and its diameter may be obtained accurately by multiplying the pitch diameter by 0.968 which is the cosine of 14½ degrees.

The diameter of the base circle will then be 19.098 × 0.968 = 18.497 inches.

Referring now to the table we find it contains constants for two values, the face radius and the flank radius which are to be multiplied by the circular pitch. For 30 teeth these constants are 1.29 and 0.88 which multiplied by 2 gives 2.58 and 1.76 respectively. Having marked off the width of the tooth

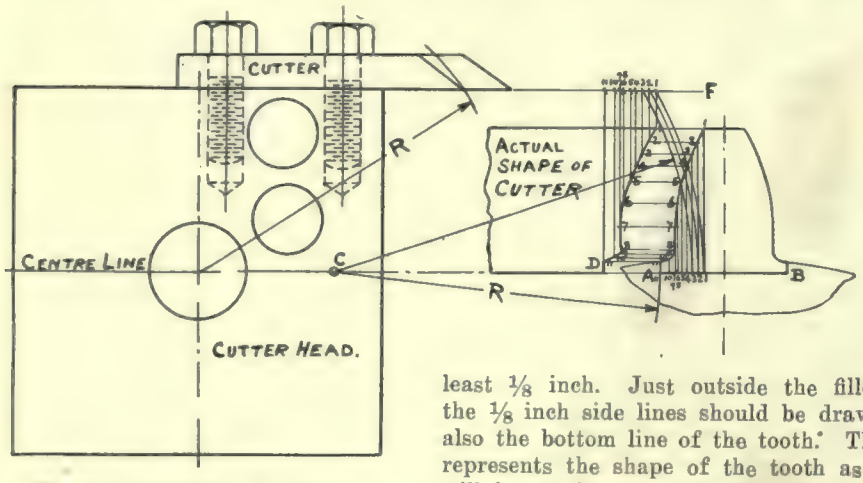



Fig. 2.—Development of cutter.

on the pitch circles, arcs should be drawn through these points, outward with a radius of 2.58 and inward with a radius of 1.76, the centres of these arcs being on the base circle. The flank of the tooth should be drawn radially with a line tangent to the inner arc. A fillet should join the tooth curve proper and the circle at the bottom of the tooth. In this case it was made ⅛ inch.

The following formulas have now been used:—

$$\text{Pitch diameter} = \frac{\text{Circular Pitch} \times \text{No. of Teeth}}{3.1416}$$

Addendum=Circular Pitch×0.3183.
Dedendum=Circular Pitch×0.3683.
Total Height of Tooth = Addendum + Dedendum.
Outside Diameter = Pitch Diam. + Twice Addendum.
Blank Diameter = Pitch Diam. — Twice Dedendum.
Base Circle = Pitch Diameter × 0.968 inches.

There are several methods of making the pattern for a spur gear. One method is to turn up a blank to the outside diameter of the gear and then lay out the teeth on each side, cutting or sawing them out, and then finishing by hand. This is rather tedious and the shape of the teeth will vary considerably. The teeth may also be cut to a templet and then sandpapered and fastened to the blank. In the method about to be described the teeth are machine-cut, all teeth being of exactly the same profile.

The cutter head is of cast iron and may be bored to fit the arbor of a table saw. The removable plate of the saw table is replaced with a wooden one and the cutter head raised up through the board cutting a space for itself. In this case the head was 4 inches square and 1½ inches thick.

The tooth should now be laid out by the method just described. In cutting the teeth the fillet at the sides will be integral with the tooth itself, and the teeth should be set into the blank at least ⅛ inch. Just outside the fillets the ⅛ inch side lines should be drawn, also the bottom line of the tooth. This represents the shape of the tooth as it will be set into the blank.

Now extend the bottom line and at one side draw the cutter head using the extended line as a centre line. The cutter will be made of tooth steel of any desired thickness and may easily be fastened to the head by means of two cap screws. Were the cutter placed radial, it would then be of the same shape as the tooth but this would not give a cutting edge so that it is necessary to place the cutter on the edge of the block striking the pattern at an angle. It is thus necessary to develop or lay out a curve which at this angle

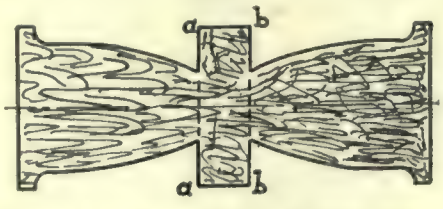



Fig. 3.—Tooth strips, after being cut.

will give a tooth of the predetermined shape. To determine the position of the cutter let us assume that the part which cuts the straight side of the tooth as at "A," is set ¾ inch from one side of the head. Laying this out, take the distance from this point to the centre as shown at "E." With this length strike back from the point "A," on the centre line intersecting at "C." This is the centre from which all arcs will be drawn.

Now choose any number of points along the tooth curve, and for convenience in locating, number them as "1, 2, 3," etc., and project these down upon the centre line, numbering there to correspond. From centre "C" draw arcs from all these points to the face of the cutter, extended, as at "F" numbering as before. From these points project downward, intersecting lines drawn through the original points parallel to the centre line. To be specific, project down, for instance, from point "2," also draw a line from point "2" on the tooth shape parallel to the centre line and the intersection of these two lines will give a point on the cutter.

Doing this for all the points and drawing a curve through same gives the shape of the cutter. The more points chosen the more accurate will be the cutting shape. The width of the cutter will, of course, be the same as the height of the tooth.

The cutter must be backed off to give a proper cutting edge and to allow for clearance and, after hardening, is ready for use.

In laying out the cutter, difficulty will be experienced, as for instance, at points "7" and "8," the lines being so close, makes it rather hard to distinguish between them. For this reason the first tooth cut should be compared with the original shape and any slight errors may be corrected by honing the cutter.

The material for the teeth may be cut in any desired lengths and should be made in thickness equal to "AB," while the width should be greater than twice the total height of the tooth. A guide should be placed on the saw table just in line with the side of the cutter corresponding to "AB" and the head then brought up through the table until the point "D" of the cutter just touches the face of the wood, the piece may then be turned over and the teeth will come the right thickness without further adjustment.

The strips, after being cut, will appear as in Fig. 3. They may now be sawed along lines "aa" and "bb" which will separate the two strips of teeth. The projecting parts serve to keep the strips flat while sawing. The teeth can now be cut to the desired length and are ready for attaching to the blank.

## THE CONVERTER IN THE FOUNDRY.

By E. B. Gilmour, Toronto.

IN any process for the successful production of steel, two conditions are necessary—perfect and absolute control over quality of material, and regularity of production. To fulfill these, designers of the converter came forward

and proclaimed it as the panacea of all evils in the production of steel castings. Further, they stated that any intelligent man could be taught to handle a converter steel plant in from 2 to 3 weeks' training under an expert, for it only required the proper mixture charged into the cupola, drawn off with a certain analysis, poured into the converter, and the "blow" started, in order to have in 15 minutes, two tons of steel ready to receive the additions deemed necessary to bring it to a desired specification.

The above ideas having been spread broadcast, many were encouraged to enter the steel converter business, and as a result, failure and condemnation of the system was the reward of all, except a few who had the money and stamina behind them to get down to certain hard facts that had to be faced.

The procedure adopted was to hire a college graduate as chemist, put him in charge of the cupola and converter at a salary of $40 to $50 per month, in the expectation, not, however, realized, that steel castings would be produced at 3 cents per pound, and sold at 4 or 5 cents per pound. I have in mind the starting of a company which figured as stated. They had visited some of the successful concerns, and thought they had only to go home and do likewise. They tried to take the steel from the converter in bull shanks, as you would cast iron from the cupola, but to their surprise, failure of every description appeared, and before long they were out of the steel business. Another company, with which I am familiar, have now got over the hard knocks of experience and are running from 15 to 20 heats per day in a 2-ton converter. A heat is melted, blown and poured every 25 minutes after the first, and this at an average loss of 15 per cent. of metal handled, pouring with a tea-pot spout ladle and also into bull shanks, to cast regular snap work. In this plant they had a practical foundryman at the head and an expert chemist with efficient assistant in charge of the cupola and the converter.

### Varieties of Converter.

There have been many varieties of converter put on the market, although all practically embody the same ideas. The differences lie in the tuyere arrangement. This being the vital part, any deviation from the correct style resulted in a proportional amount of trouble.

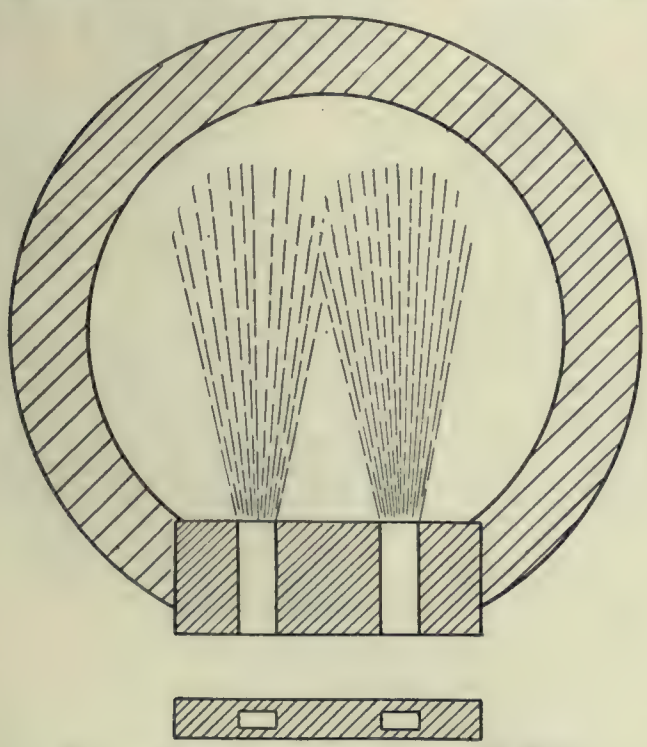


Fig. 1.—System of Tuyerage for Converter Blast.

Fig. 1 is a system of tuyerage with only two openings for the blast to enter. This caused the blast to be concentrated in two portions of the surface of the metal, as shown, and during the "blow" it formed a double eddy by which the slag whirled around the converter next to the lining and dropped over the tuyeres, practically closing them up. As a consequence, every little while the blast had to be stopped to clear them. Under such circumstances, the blowing period was, of course, increased, the time taken being from 40 to 45 minutes instead of from 12 to 15 minutes. Extra power was also consumed, and in addition, insufficiently hot metal resulted.

Fig. 2 is another system of tuyerage, constructed with a number of small holes about ¼ inch diameter, in such manner as to distribute the blast over the whole surface of the metal in the converter, thereby securing a regular and steady boil, with hotter metal of more uniform kind.

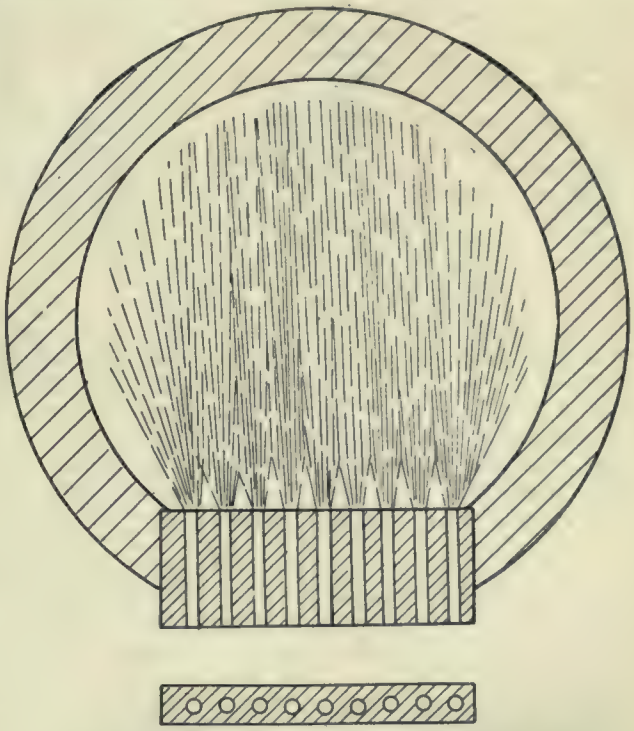


Fig. 2.—System of Tuyerage for Converter Blast.

In charging the cupola, one should aim to use as much steel scrap as possible so as to reduce the cost of production. On account of the steel being low in carbon, it will, in passing through the cupola, absorb that element from the fuel and become so saturated that you will only have to supply silicon in the form of pig iron to reduce the total loss of metal in the whole melt. The amount of silicon required in the mixture should not be over 2 per cent., and with experience in blowing, it can be reduced to an even greater extent. It is desirable to keep the sulphur and phosphorus as low as possible, and in order to get rid of the former some converter people have tried to melt the iron with oil, instead of coke. The introduction of the electric method bids fair to revolutionize the steel business, by taking the place of the crucible and converter, especially where cheap power is obtainable.

Molds for steel castings, especially those of the latter which have to be machined, are nearly all made in dry sand. If machining is not required, they may be cast in green sand, but under the skin small blow holes are much in evidence. The final additions to the converter are made by various means, but preferably in a small cupola. Some people, however, use a crucible.

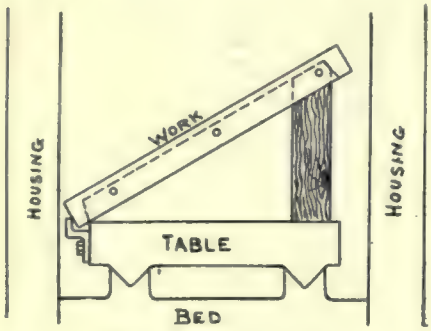
# MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

## SPLITTING OLD HOSE BAGS.

By W. B. Crockett.

THE device here illustrated is a small motor-driven shear specially designed for splitting worn-out hose-bags and removing the wire, in order to recover the scrap value of the rubber. One end of the hose-bag is placed over the nose B of the moving blade-plate A, fig. 1, and as it is cut by the blades D and E, it divides and passes on either side of the neck C, as may be clearly seen in fig. 2. The hose is fed forward by hand and split from end to end. It is then reversed and fed through a second time, splitting it on the opposite side and so dividing it into halves. The two unwired ends of the hose are next cut off, after which the outer covering over the wire is easily stripped, and the wire drops out.




Facing Wide Castings.

Fig. 1 shows the construction of the machine, while from fig. 2 a clear idea of its operation may be obtained. It will be noted that the gears are covered in with a neat casing. Railway men will, of course, be well acquainted with the meaning of the term "hose-bag," but for the benefit of other readers it may be as well to explain that a hose-bag forms the flexible connection between the water-valve on the tender and the injector suction pipe on the locomotive, and consists of a tube of rubber and duck, stiffened with a wire coil, except for a short distance at each end.

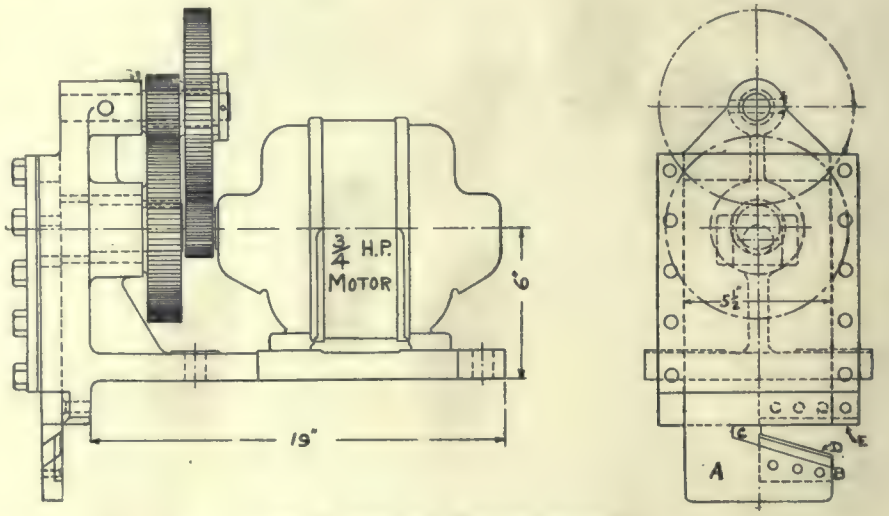



Fig. 1—Hose Bag Splitting Machine.

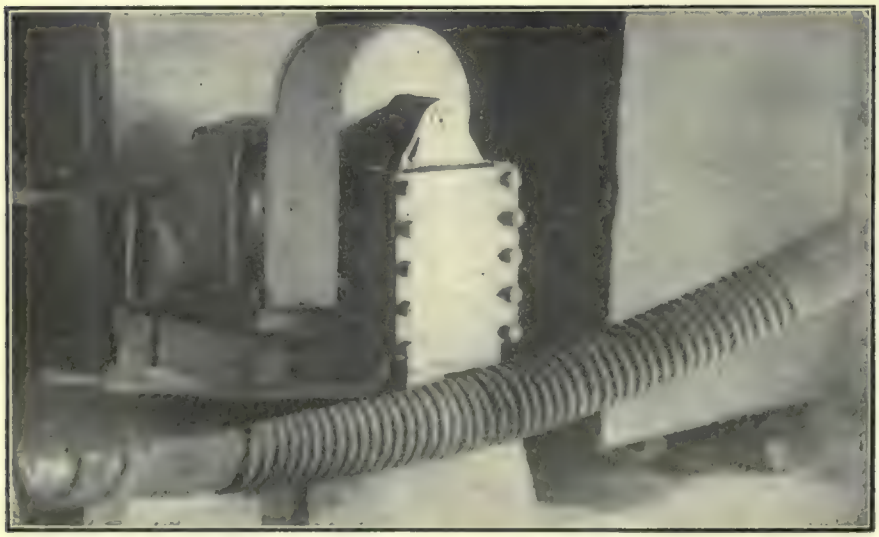


Fig. 2—Hose Bag Splitting Machine.

## FACING WIDE CASTINGS.

By Donald A. Hampson.

A MANUFACTURER of tinware sent us a number of cast-iron plates to be faced-off on the planer. When they arrived, it was found that they were too wide by ½ inch to pass between the housings of the planer. At the ensuing consultation, permission was given to take ¼-inch full off the ribs on each side, it being left with us to do the job in the cheapest way possible. Chipping was instantly discarded as being too laborious and costly, and on further consideration the necessity for reducing the plates' width before planing was overcome by setting them up as shown. The planer had at one time been drilled throughout the whole length of the table for side clamps, and these holes we now proposed to use. To that end the blacksmith made a pair of Z pieces out of ⅝ x 3 inch stock. These were bolted to one side of the table, at points near the ends of the position which the plates were to occupy. This and the manner of setting the work is shown in the illustration.

The work was supported at an angle of approximately 30 degrees by lengths of hardwood blocking, and by the Z pieces, the ribs across the ends resting at one point on the table. Holes for finger clamps had been drilled and the thrust of the cut was provided for by posts and an angle plate. It only remained to set over the head 30 degrees and throw in the down feed.

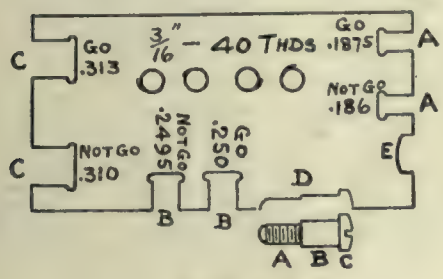
## A SCREW GAUGE.

By Chas. Hattenberger.

THE type of gauge here shown has proved very useful to those engaged in making large numbers of screws, pins or almost any form of screw-machine work.

The example here illustrated is used for gauging the 3-16-inch screw shown.

It is made from a flat steel plate and has three pairs of slots in it, A.A., B.B. and C.C., which form limit gauges for the corresponding diameters of the screw. D. is a profile gauge, while E gauges the radius of the screwhead. The




A screw Gauge.

holes shown are for gauging the thread and are tapped out with a master tap. If they shrink during the hardening process, it is best to turn-up and thread a piece of copper in the lathe chuck, and use this as a lap with fine emery flour and oil. If one of these holes should wear large through use, plug it up to prevent mistakes.

In making this gauge cold-drawn machinery steel may be used if facilities for carbonizing are at hand. Use stock ⅛-inch thick for screws up to 3-16-inch diameter, and 3-16-inch thick for screws up to ¼-inch diameter. This type of gauge is not well suited to screws over ⅜-inch diameter. The snap gauge openings A.A., B.B., C.C., are made .010 inch small, and afterwards ground and lapped to size. The profile gauges, D and E, are made to size, but should any change take place in the hardening, they are lapped and oil-stoned back to the correct shape.

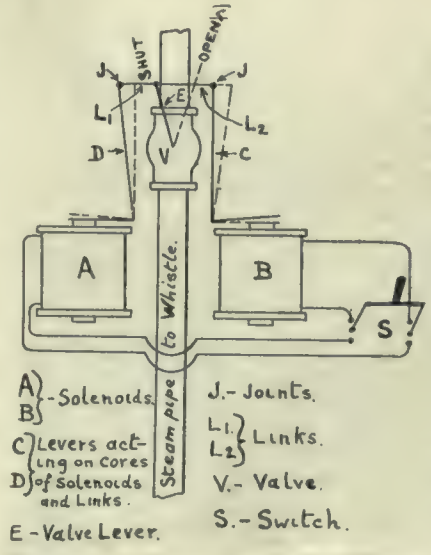
## BLOWING THE WORKS WHISTLE.

By John E. Davies.

IN the accompanying illustration is shown a device for "blowing the works whistle" from the office. The steam pipe leading to the whistle must be brought to a convenient place in the wall. Using an inch pipe we connect to it an easy-working but steam-tight valve V, which will, with a turn of about 60 degrees, open full. A lever, E, is attached to valve V to operate same, and to this lever E are attached the links L1 and L2. These are connected to bell crank levers D and C, and are acted upon by the solenoids A and B.

In the illustration, the valve is shut. Closing the upper circuit through solenoid A, the core, becoming magnetized, attracts the short leg of the bell crank lever C, and moves the long leg, link L2 and lever E to the position shown by the dotted lines, thereby opening the valve V and blowing whistle. Further, link L1, and bell crank lever D, are put into the position shown by the dotted lines, thus lifting the short leg D off the core of solenoid B.

To close the valve, open the upper circuit and close the lower. This sends current through solenoid B and reverses the process. When valve is closed, open the switch S.




Device for Blowing the Works Whistle.

## GRINDING A CUT-OFF TOOL.

By C. T. R.

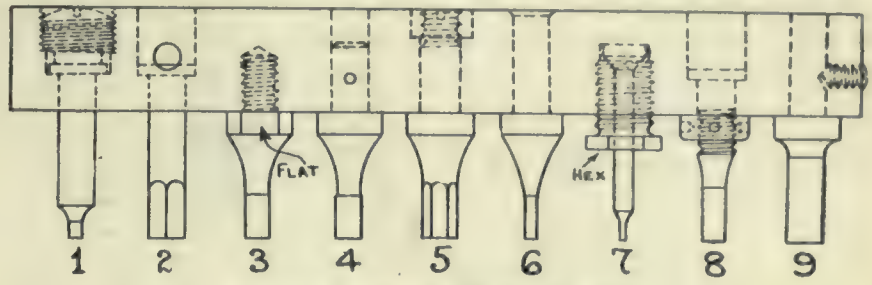
WHEN cutting off pieces of steel in the lathe the operator is often troubled by the tool digging in and snapping off. This difficulty may be overcome by grinding the tool as at A in the illustration, and making the

Grinding a cut-off tool.

radius larger than the radius of the piece being cut off. By grinding in this manner the tool is made much stronger than when ground in the usual way shown by the dotted line at B.

## SECURING PUNCHES IN HOLDER.

THE accompanying cut shows nine different methods of securing punches in a punch holder. In No. 1 the punch is inserted from the top and the




Methods of Securing Punches in Holders.

thrust taken by the screw shown. No. 2 is also inserted from the top, a hole being drilled through the holder at right angles to the punch, and a pin, with a flat filed on it, a few thousandths of an inch taper, is driven in to bear on the top of the punch. No. 3 is merely screwed into the holder, the collar being provided with two flats to fit a spanner. No. 4 is held in place by a standard taper pin; but this method is not to be recommended. In No. 5 the punch is held by a round nut having a slot across its centre by means of which it is tightened.

The punch shown in No. 6 is made a snug fit in the holder, and is then riveted over at the top. This method holds the punch securely, but has obvious disadvantages when it becomes necessary to remove it. Punch No. 7 has a countersunk head and is held in place by a long nut bored to fit. No. 8 is inserted from the top, being threaded for a portion of its length and drawn up tight by a round lock nut. No. 9 is held in place by a headless set screw, the point of which fits into an angular slot across the punch shank. The screw point should engage the slot a little above the centre in order to draw the punch up tight.

## CUTTING A QUADRUPLE THREAD.

By A. Leonard Marshall.

I WAS recently called upon to cut threads in a nut to match a 1-inch diameter screw, having a quadruple thread of 1-inch lead. Instead of dividing the face plate into four parts, I selected a lathe having a lead screw with 4 threads per inch, and, of course, geared same to the spindle with 4 to 1 gears. After setting the tool near the edge of the nut, and marking the bed of the lathe at the back of the carriage, I closed the split nut and took a cut. I next marked the lathe bed in front of the carriage, and while the lathe was at a standstill, I moved the carriage ¼-inch toward and past the back mark, closed the nut again and took another cut, being careful to stop exactly at the front mark when the tool was

through. Repeating the operation, I brought the carriage ½-inch toward and past the back mark, then ¾-inch, and at the next and last movement picked up the first cut.

The method adopted gave me a chance to try in the screw as the threads neared completion, and also ensured the pitch being as accurate as that of the lead screw.

## RELIEVING ATTACHMENTS FOR THE LATHE.

By A. D. Campbell, Hamilton.

THE accompanying half-tone shows a relieving attachment for a 14-inch lathe which has proved very effective on all kinds of taps and special shaped

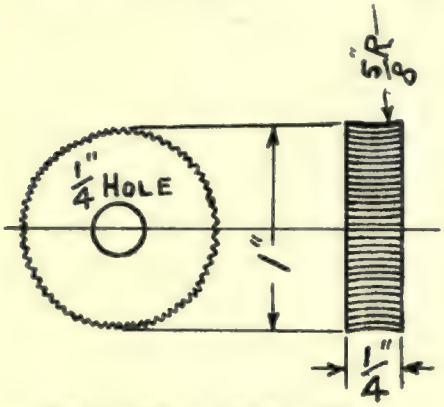



Fig. 1.—Cutting Teeth on Knurls.

milling cutters. The face gear being the most solid gear on the machine, power is taken from it through a 3 to 1 ratio of gearing. The bracket bolted to the lathe bed carries a radius arm to which are attached suitable train gears for the number of flutes in the work. The regular train gears are used. This device will work any even number of flutes from 2 to 16. The tool block slide is held against the cam by a stiff spring, the tension of which may be adjusted by means of a screw. The whole slide can be swivelled around, 30 degrees, either

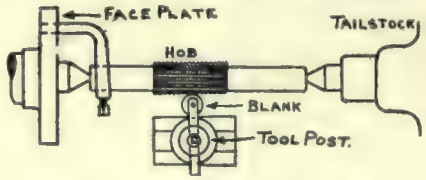



Fig. 3.—Cutting Teeth on Knurls.

way. Four cams have been provided: 1-64, 1-32, 1-16 and 1-8 inch.

Since the photograph was taken, a bracket has been fitted on the left hand side of the swivel slide. This carries a shaft, with a pair of bevel gears, one of which, on the cam shaft, replaces the swivel joint fork shown. The latter was transferred to the other end of the bracket shaft, and connected with the telescoping shaft. Relieving the tooth side of square-threaded taps has been greatly facilitated.

## CUTTING TEETH ON KNURLS.

By Charles Hattenberger.

SOME time ago I had a job to make about sixty knurls as shown in fig. 1. They required to be approximately 1 inch diameter, and to have 80 degree teeth, 1-32 inch apart. My first thought was to mill them, but this would have proved too tiresome, so I concluded to hob them. I made a hob 1¼ inches diameter, 32 threads per inch, and having twelve flutes 3-16 inch wide.

The fixture shown in fig. 2, is made of soft machinery steel, carbonized, and the pin with the knurled head is made of tool steel. This fixture is held in the lathe tool-post, and the blanks, after being turned up, are inserted in the slot and held in place by the pin. Care must be taken when setting, that the slot and lathe centres are in line, and that the blank rotates freely in the slot. With the lathe carriage stationary, the blank is gradually fed into the hob until the teeth are fully developed. Fig.3 shows the arrangement.

## LATHE TOOL FOR TURNING HAND WHEELS.

By L. C. D.

THE tool here shown is handy for turning up outside radii, such as the rims of handwheels and similar ob-

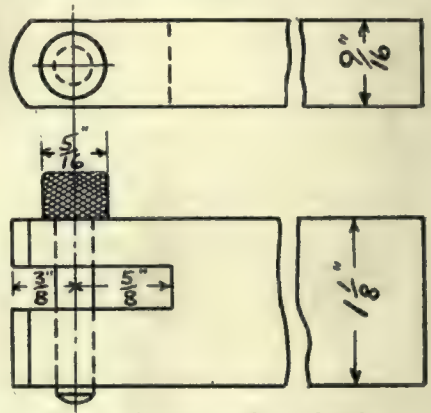



Fig. 2—Cutting teeth on knurls.

jects. As may be seen in Fig. 1, it consists of a ⅝ inch diameter piece of tool steel, with six cutting edges ground in its circumference, each to a different radius. In grinding, 5 to 7

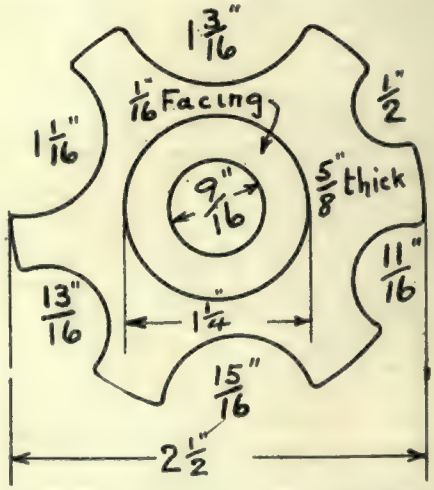
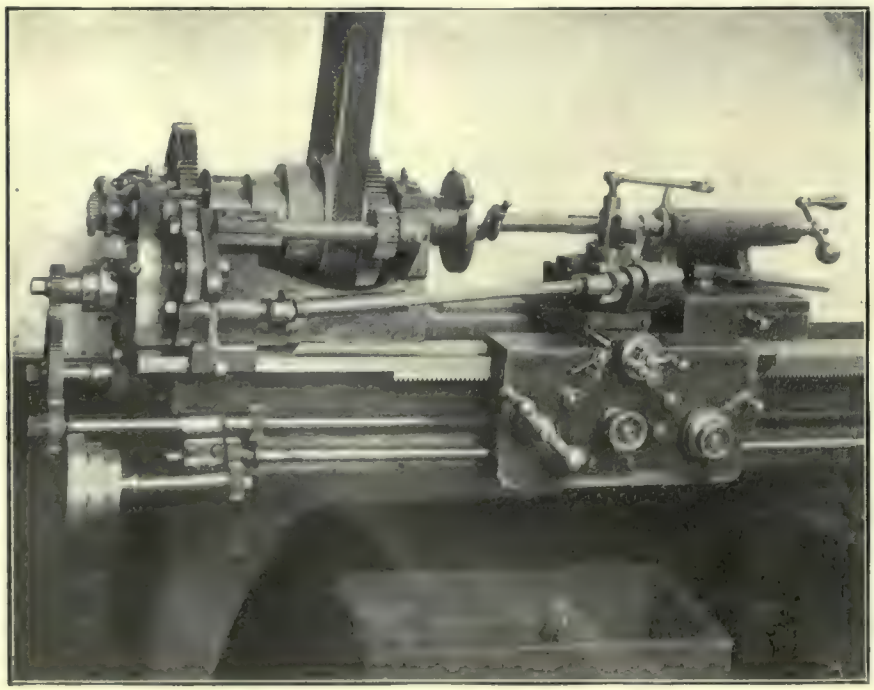



Fig. 1—Tool for Turning Handwheel Rims.

degs. of clearance is given. The sizes given, which are stamped on the tool, show the diameter of the finished work and not the radius of the cutter. Fig.



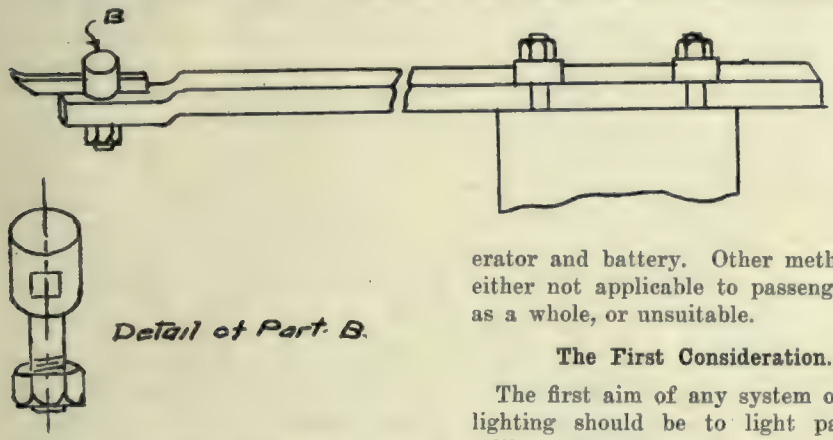
Relieving Attachment for the Lathe.

2 illustrates the spring tool-holder used in connection with the device. The tool is adjusted with the required cutting edge towards the front, and then clamped in the holder by means of the bolt through its centre.

## A HANDY TURNING TOOL.

By A. L. Marshall.

THE tool here shown has proved very useful in a large lathe for turning work that will not swing over the carriage, or for boring large holes. The bar is drilled and counterbored to take the




A Handy Turning Tool.

bolt B, the counterbore being deep enough to prevent the shoulder of B from resting on the bottom when the tool is clamped in place. The bolt holds the tool securely at any desired angle. The bar is made from heavy square stock, the end being set down to suit height of the lathe centres.

## ELECTRIC LIGHTING OF TRAINS.*

By Roger T. Smith, B.Sc.

THE method of train-lighting considered is that in partial use on the Great Western Railway, where axle-driven dynamos and batteries controlled by an automatic regulator are installed on brake-vehicles only. The lamps throughout the train are supplied from these equipments, which work in parallel with each other, the brake-vehicle equipments and the lamp wiring in the coaches dependent on them being connected electrically by through wiring coupled between coaches. There is, consequently, an appreciable reduction in initial cost and upkeep of plant, and, what is of chief importance from the railway point of view, increased reliability. Mr. William Langdon's paper, read before the institution in 1891, describes his, the first attempt to light electrically passenger rolling stock in general, in place of lighting set or block trains which were never broken up in traffic. Mr. Langdon's final method provided one axle-driven dynamo in the block part of a main line train, and a battery on each of the other coaches. All coaches were electrically coupled, and when disconnected, the lighting of each coach was continued during its branch journey by means of the charged battery. For any method of electric train-lighting applicable to all passenger rolling stock, the alternatives are either some such method as proposed by Mr. Langdon, or that every coach is "self-lit," that is to say, provided with its own axle-driven generator and battery. Other methods are either not applicable to passenger-stock as a whole, or unsuitable.

### The First Consideration.

The first aim of any system of train-lighting should be to light passenger rolling stock adequately and with reliability. Measurement and experience lead to the provision of an illumination, measured on a horizontal plane at eye-level, of 2 foot-candles in third class, and 2½ foot candles in first-class compartments. Glare or dazzle can be minimized if not entirely prevented by keeping lamps out of the line of sight; by providing a white background behind the glowing filament, or by reducing the intrinsic brilliancy of the latter by enclosing the lamp in a diffusing or Holophane globe; the latter at the same time improving distribution. The tungsten train-lighting glow-lamp now replaces

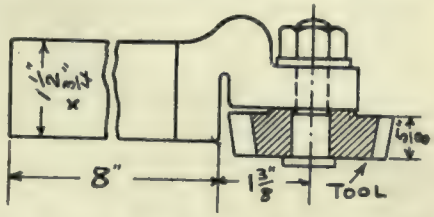



Fig. 2—Tool for Turning Handwheel Rims.

the carbon glow-lamp, its present most economical efficiency being 1.3 watt per candle. On the average, tungsten glow-lamps, with a useful life of 850 hours, have to be changed only once a year in the electrically-lit coaches on the Great Western Railway, where lamp-voltage is regulated within plus or minus 2½ per cent.

Any axle-driven system must, in the first place, provide a lead-cell or other accumulator, so that the lamps are lit whether the train is standing or moving throughout its range of speed. In order to draw proper attention to the importance of the accumulator in train-lighting, it is both convenient and useful to look upon the accumulator as the essential element and on the dynamo as a device for making the output of the former continuous throughout the hours of lighting. As typifying the accumulator, the lead cell alone is considered. The two extremes, among methods of charging lead cells, are charging at constant voltage and charging at constant current, but a method of charging which combines the advantages of both extremes, while avoiding their disadvantages, is recommended, the charge being completely under the control of an automatic regulator set to give the proper compromise. The arrangement consists in starting with a heavy charge and gradually reducing it, until, after proper gasing has taken place so as to mix the electrolyte, the charge is stopped when the cells are full, or the battery is left floating on the load while lights are on. Automatic regulation is necessary to secure a long and healthy life for the lead cell, and to reduce maintenance, it is essential. When properly arranged, 10 per cent. per annum of the initial cost of the whole cell will provide for both maintenance and renewals of the plates and boxes.

### Automatic Regulation.

The train-lighting dynamo is of secondary interest as compared with the battery, the essential element being some means of keeping the voltage constant at all speeds while permitting of its automatic variation by the regulator when required. The suspension and driving of the dynamo and the reduction of belt losses and renewals are among the chief factors in success. The automatic cut-in cut-out switch for connecting or disconnecting the dynamo from the battery should be actuated electrically, since the voltage of the latter may vary 25 per cent. from that of the former at any given speed. It is desirable that this switch should also act as an instantaneous automatic reverse-current circuit-breaker. The problem of automatic regulation has not attracted the British inventor as compared with other inventors on both sides of the Atlantic. The functions of an ideal regulator, combining in one or two instruments, battery and lamp-voltage regulation, may be defined briefly as the following: First, it must control the lamp-voltage within plus or minus 2½ per cent. of the rated voltage of the lamps, and, within reasonable limits, must do so independently of lamp-load and entirely independently of battery-voltage. Secondly, when lamps

*Abstract of paper read before the Institution of Civil Engineers, London, Eng., Nov., 1911.

are off, the regulator must control the generator-field so as to provide the full output of the dynamo for charging an empty battery; and when lamps are on, the balance of the full output must be available for charging. As charging proceeds, the regulator must control the inherent regulation of the dynamo so that its voltage only rises sufficiently to give a diminishing charging current. Thirdly, with a fully charged battery and lamps off, the regulator should reduce the charging current to zero. Fourthly, with a fully charged battery and lamps on, the dynamo output must be adjusted to equal the lamp load, leaving the battery in a floating condition with current neither entering nor leaving it. The foregoing requirements can to-day be obtained combined in one piece of apparatus.

**The Brake-Vehicle Method.**

An experimental six-coach train lit on this method was run nearly continuously for two years in all sorts of traffic, varying from fast main-line services to slow, stopping, local services. Two brake-vehicles, equipped with 45-ampere dynamos, regulators, and 180-ampere batteries, light themselves and three dependents. A self-lit detachable coach completes the train. The Leitner system provided the only available apparatus able to meet the special conditions. All the equipments are in parallel, coupled by cables throughout the train, so provided. For the lighting circuits, the through wiring and method of coupling is arranged on the loop-positive system, one regulator controlling the lamp-voltage on each side of the loop. The same looped-positive brake-vehicle method has been applied to two trains running on South Wales services, to two new trains specially built for the Cunard boat service between Paddington and Fishguard, and to two new trains used for Birmingham local services; and it is being further applied.

The total annual cost of lighting a six-coach train on the looped-positive brake-vehicle method is as follows. The cost of the initial equipment would be $3,800, inclusive of all carriage-work charges. Adding working-costs, extra cost of locomotive-power — determined experimentally—and capital charges, the total annual cost becomes :—

| | |
|---|---|
| Working costs ... ... ... ... | $225 |
| Power to drive dynamos, 1½ per cent. on $4,375 ... ... ... | 65 |
| Haulage of extra weight, 1.7 per cent. on $4,375 ... ... ... | 75 |
| Interest on $3,800 at 4 per cent. ... | 150 |
| Reproduction of capital in 20 years at 3 per cent. ... ... | 115 |
| Total annual cost of lighting a six-coach train..... ... ... ... | $630 |

With regard to the safety of electric train-lighting, although at 22 volts an arc can be formed between any of the metals employed in train-lighting, this arc will not persist. Provided the ordinary precautions necessary with electric circuits are taken, and suitable fuses are used and properly maintained, it is believed that complete immunity from fire risks can be ensured.

## HARDENING AND TEMPERING CARBON STEEL TOOLS.

By Frank Walker.

STEEL tools, used in the mechanical operations of turning, boring, punching, etc., are subjected to fit them for their several purposes to three general heat treatments or processes — forging, hardening and tempering; the two last being perhaps the most important through which they pass, and probably also the least understood by the average mechanic.

Carbon steel, properly treated, will be found, in nine cases out of ten, to answer all the requirements of the general or jobbing shop, and to be far more economical than the expensive high-speed alloy-steels from which best results are only to be obtained under conditions non-existent in the average machine shop. Carbon steel is the name given to a combination in various proportions of iron and carbon. There are also present, as impurities, other elements and metals, but carbon is the element which determines its characteristics and directly governs the hardening qualities. The amount of carbon present varies within certain limits from .5 to 2.2 per cent., and is known as the "carbon content" of the steel. Carbon steels are generally divided into two classes—the "unsaturated," in which the carbon content is less than .89 per cent., and the "super-saturated," in which the carbon content is greater than .89 per cent. The saturation point is fixed at .89 per cent.

**Hardening and Tempering An Old Art.**

Hardening and tempering have been practiced, with more or less success, from time immemorial, and some of the old sword blades to be seen in our museums, are splendid examples of the craft. At the same time their production determined no definite rules for performance or guidance, except, perhaps, a general one—that steel should always be hardened on a rising heat and at as low a temperature as possible. Careful experiments carried out during recent years have determined, without doubt, that the hardening process proceeds along certain definite lines and within certain definite limits, and these, if carefully adhered to, will always assure success. The old rule, already quoted, though very indefinite, will be found to agree closely with those which modern research has brought to light and taught.

To harden a piece of steel, it is not merely sufficient that it be heated and then suddenly cooled. In order to ensure certain and perfect results it is absolutely necessary that the right temperature be obtained, because inability to determine this, on the part of the operator, is the reason for so many failures in hardening. The temperature of the cooling medium is also subject to limitations.

**The Temperature Factor.**

In the process of heating there is a certain critical temperature easily determined by the proper means, at which steel will harden with the best results and with adsolute certainty. This, known as the "point of decalescence," is one of the most peculiar and least known characteristics of carbon steel. I will endeavor to give an elementary explanation of the phenomenon, and also of the manner in which its occurrence is demonstrated. In the bar of tool steel as received from the manufacturer, the carbon is not distributed equally throughout the mass, but is carried in a particular way; one atom of carbon allying itself with twenty-one atoms of iron and forming an alloy known as "pearlite." This "pearlite" is distributed through the bar in spots or islands surrounded by free carbonless iron called "ferrite." If heat be applied to the bar, its temperature will commence to rise and continue to do so until a certain point is reached, at which atomic changes take place within.

The "pearlite" becomes broken up, and its carbon content changes its nature and becomes "cementite" or hardening carbon, which enters into "solid solution" with the "ferrite." This readjustment is accompanied by two marked peculiarities, whose observation determines the exact period at which the change occurs. In the first place, the steel loses its power of attracting a magnet, and in the second, the temperature of the piece stands still, or even falls slightly, for quite an appreciable length of time, although heat be still applied. This is due to the chemical action having absorbed the added heat. After the change has been completed, the temperature of the piece again commences to rise, and will continue to do so proportionally.

Should the steel be now removed from the influence of heat and allowed to cool slowly, it will pass through another critical period called the "point of recalescence." This marks its return to the original atomic structure, and occurs at a lower temperature than the

point of "decalescence." At this stage the heat, absorbed by chemical work in the previous period, is again given off, and causes the falling temperature to remain stationary for a short time, or even to rise slightly, although the surroundings be much colder. At the same time the steel regains its power of magnetic attraction.

The accompanying diagram, copied from one taken with a registering pyrometer, clearly shows the two periods, and it must be understood that the second cannot take place unless the first has been passed. Now, as this point of "decalescence," which varies with the carbon content, marks the exact temperature at which the particular steel being treated will harden with the best results, and as no definite rules for it can be quoted by which the operator can be guided, it becomes necessary to determine this temperature by actual experiment. This can be done by connecting a registering pyrometer, several types of which are made, with a small gas, oil or electrically heated furnace. A small test piece from the steel to be hardened should be attached to the terminal of the pyrometer, the furnace brought up to a temperature of about 1,700 degs. F., and the test piece placed in it. The latter heats rapidly, and its temperature, as recorded by the instrument, will rise uniformily till the "decalescence" point is reached. A noticeable halt then takes place in the upward movement of the needle. The piece should now be quickly removed from the furnace and its color carefully noted, as showing the proper heat for hardening that particular steel. The experiment should be repeated and results compared to verify the record.

Should a pyrometer not be available, a very good substitute is a magnet. Again, the heat color of the "decalescence" point of a steel may be very accurately determined by the following means: Place a small mariners' compass on a wooden stand close to the fire or furnace in such manner that the heated piece can be swung close to the magnet in a plane parallel to the needle, that is, north and south. If using a blacksmith's forge, the piece should be heated in a muffle made from a piece of wrought iron pipe. Heat the piece slowly, withdraw and test it frequently with the compass, using for the purpose a pair of pliers made by bending a piece of strong copper wire. The heat at which the piece ceases to attract the needle is its "decalescent" point, and the color should be carefully noted as in the experiment with the pyrometer.

### Color and Temperature.

Once the proper heat has been determined it is possible to successfully harden without fear of failure each and every tool made from that particular steel. The color of a heated piece is a fairly accurate guide to its temperature, and the following table gives approximately the value in deg. F. of the various heat colors: Faint red=950, dull red=1150, brilliant red=1350, cherry red= 1550, bright red= 1750, orange =2000, bright orange=2190, white= 2370.

I have endeavoured thus far to explain the principles which govern successful heating, but it must be remembered that success also depends upon the manner in which the steel is heated.

### Manner of Heating.

When hardening steel, it should never be heated in direct contact with the fire. If a special furnace is not available, a muffle made, as explained already, from a piece of wrought iron pipe, should be placed in the fire, and brought to a bright red heat before the piece to be hardened is placed in it. The muffle should not be too large, but of just sufficient size to enable entry and withdrawal to be made by means of a pair of tongs. It should also be so built in

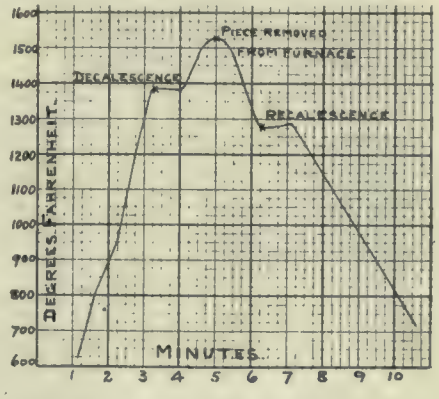



Diagram showing "Decalescence" and "Recalescence" Periods

the fire that all parts of it can be evenly heated by using a steady blast.

Great care must be taken that an even temperature be given those parts of the tool that require to be hardened, and it is advisable to continue the heat even for a short time after the "decalescence" point has been reached, for two reasons. In the first place, it insures the chemical change taking place, not merely on the surface, but through to the centre of the piece; and, secondly, it allows for the loss of heat by radiation, which takes place when the piece is removed to the quenching bath.

### Cooling or Quenching.

Cooling or quenching, which sets or fixes the "cementite" in "solid solution" with the "ferrite," and completes the hardening process, requires as great care as heating, and here, again, temperature is a governing factor. There are three cooling mediums in general use—water, brine and oil, but for carbon steel tools, water is undoubtedly the safest and cheapest. Careful experiments have shown that rain water at a temperature of 45 to 50 degrees Fah., gives the best results. Temperatures below 45 degrees have a tendency to cause the steel to crack and warp. Again, should the bath be too warm, the hardest results are not obtainable. When dipping, care should be taken that the tool enters the bath vertically and point or edge downwards. It should not be held stationary in the bath, but moved gently from side to side, in order that cold water may constantly come in contact with its heated sides, thus insuring a quick, uniform reduction of temperature.

The tool should be allowed to remain in the quenching bath until it has been reduced to the same temperature as the bath itself, and when withdrawn, if the methods explained have been carefully followed, it will be found to have attained the greatest degree of hardness possible to impart to that particular steel, without altering its shape or dimensions and without cracking and flakeing.

## C. P. R. SHOPS, CALGARY, ALTA.

Concerning the new C.P.R. shops at Calgary, Alta., it is of course known that these will occupy an area of 120 acres of good land, and will employ about 5,000 men. Other than that the shops will resemble those of the company at Montreal, no official statement has as yet been made. It is probable, however, that there will be at least twenty buildings, including freight car, passenger car, and locomotive repairing shops. The locomotive shop, will alone, it is said, cover six acres of land. The machinery to be installed will be of the very latest design and the tool equipment will be likewise very complete.

The shops at Calgary are intended to provide for repairs to equipment on the company's western lines. At one time, the Angus shops at Montreal and the shops at Winnipeg were sufficient for this work but the equipment has increased to such an extent within the last few years, that the Calgary shops have become a necessity. The following table shows the additions made to the C.P.R.'s equipment since 1886.

| | 1886 | 1911 |
|---|---|---|
| Locomotives | 372 | 1,639 |
| First and second class passenger cars, colonist and baggage cars | 304 | 1,757 |
| First class sleeping and dining cars | 47 | 211 |
| Parlor official and paymaster's cars | 27 | 63 |
| Freight cars and cattle cars | 8,253 | 50,863 |

# Mechanical Drawing and Sketching for Machinists*

By B. P.

*A Series of Progressive Lessons Designed to Familiarize Mechanics With the Use of the Apparatus Necessary to Make Simple Drawings, to Encourage them to Realize How Important a Factor it is of Their Equipment, as Well as Being a Profitable Pastime.*

THE Christmas and New Year holidays being over, the work of self-improvement should be resumed with new vigor and enthusiasm. Too often the festive season sees the end of a once firm resolve to pursue a predetermined course of study right through the winter, and a more than ordinary effort is required to combat the recreative tendency. By carefully selected examples and exercises, the writer hopes to maintain the interest of his readers until the end of the course, and will spare no pains to attain his objective.

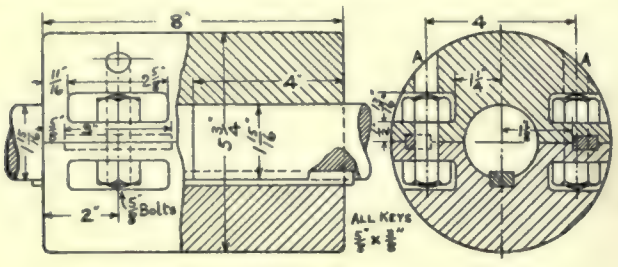



Fig. 1—Drawing and Sketching.

### Shaft Couplings.

Fig. 1 shows one method of coupling two ends of a line shaft. This is known as a split muff coupling, and consists of two similar iron castings jointed along the centre line of the shaft. By means of the four bolts with nuts at each end, the shaft is tightly gripped. For shafting larger than 3 inches diameter, six bolts are generally used. Recesses for the nuts, cast in the coupling, are made wide enough to allow of their being tightened with a spanner. The four keys on the line of the joint take the shear off the bolts, while the long key at the bottom of the shaft prevents all possibility of slipping. All the keys fit on the sides only and have no taper. The bolt holes are drilled from the circumference as shown at A. Draw to half size and add a plan view.

### Sellers' Compression Coupling.

This coupling is shown in Fig. 2, and consists of a cast-iron muff B, bored out to a double conical form, and two split cast-iron conical sleeves C.C., which are pulled together by bolts as shown. The taper of these sleeves is 3 inches on the diameter per foot of length. As the bolts are tightened up, the friction between the sleeves and the shaft becomes greater, and may be quite sufficient to prevent slipping; but as additional security, a side-fitting sunk key without taper may be added. The bodies of the bolts are made square to prevent turning when the nuts are being tightened up, or the bodies may be round and the bolt heads made square and recessed into the end of the conical sleeve against which they bear, thus effecting the same purpose. This form of coupling is frequently met with, the outside being slightly crowned so that it may serve as a belt pulley if required. Most of the dimensions necessary have been given and the student should use his judgment in supplying any omissions.

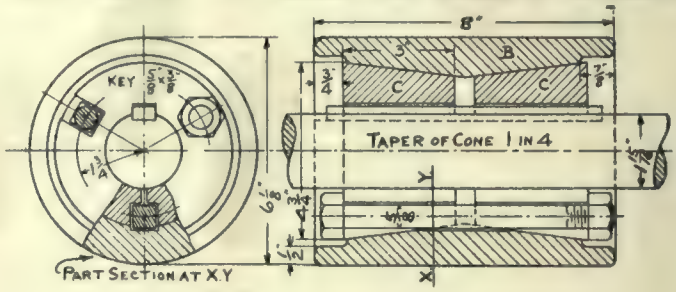



Fig. 2—Drawing and Sketching.

### Cast Iron Belt Pulley.

Fig. 3 shows a cast iron belt pulley with six curved arms. These are less liable to crack through contraction strains when cooling in the mold than are straight arms, but the latter are better in other respects, being both stronger and lighter. It is unusual to find curved arms in a pulley so small as that shown in Fig. 3, but they are there introduced in order to provide a useful exercise. Two complete arms are shown, as well as the centre lines of the other four, and the student should have no difficulty in finishing the drawing to a scale of one-fourth full size.

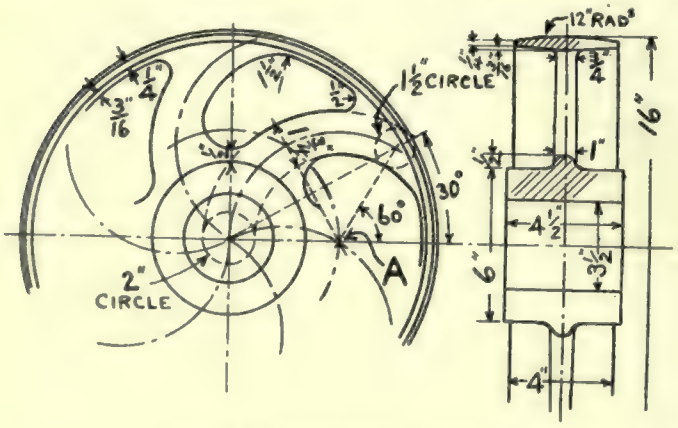



Fig. 3.—Drawing and Sketching.

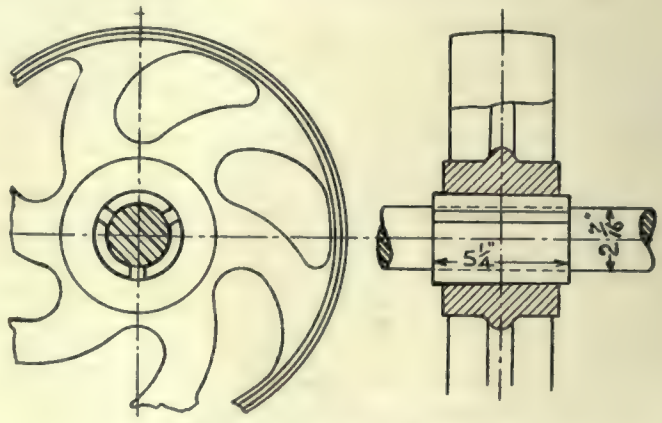


Fig. 4.—Drawing and sketching.

Having laid down the centre lines, draw a circle to represent the 16 inches outside diameter of the pulley. From the centre, draw a line at 30 degrees with the horizontal, as shown. On this line draw a circle 1½ inches diameter, having its centre ¾ inch from the outside of the pulley. From the centre of this circle

*Eleventh of a series of an Instruction Course.

draw a line at 60 degrees with the horizontal. The point A, where this line cuts the horizontal centre line of the pulley, is the centre from which the centre line of the first arm is struck, the radius of course being the distance from A to the centre of the pulley, or, what is the same thing—to the centre of the 1½ inch circle.

From the centre of the pulley draw a dotted circle through the point A; part only of this being shown in the figure. Divide the circumference of this circle into six equal parts by means of the 60 degree set square. Each of the points thus obtained will be the centre from which an arm is struck.

The arms are seen to be tapered slightly in the elevation, being 1½ inches at the rim, and increasing uniformly so as to be 2 inches wide at the centre were they extended thus far. From this it is clear, that half way between these two points the mean width will be 1¾ ins. From A draw a straight line at right angles to the 30 degree line and continue till it cuts the curved centre line of the arm. Mark off 1¾ inches width here, and through these marks draw radii to touch the 1½ and 2 inch circles. Both will have their centres very near the point A; the larger radius being centred a little to the left, and the smaller a little to the right.

The sectional view shows that the rim of the pulley is crowned to a radius of 12 inches, and that the thickness of the arms is ¾ inch at the rim and 1 inch at the hub. The section shown being a conventional one. It gives all the required information, however, and is the usual method employed when showing such objects. A true section, would, of course, show part of the arm in section, as well as the rim and hub.

The hole in the hub is larger than the shaft, to allow it to be passed over projecting collars or bosses on the latter. The cone keys shown in Fig. 4, constitute the fastening. These are of cast iron, in one piece, but nearly cut through by parting plates inserted in the mold. After boring out and being turned taper on the outside, they are then cut completely through, and form three segmental tapering keys which fill up the space between the hub and shaft.

### Exercises.

1.—Draw separately each part of the coupling shown in figure 2, together with all necessary views and dimensions.

2.—Draw a cast iron pulley similar to that shown in Fig. 3. Pulley to be 30 inches diameter, with 8 arms, and keyed to a 3 7-16-inch shaft by sunk key 1 inch wide and ½ inch thick, instead of by method shown in Fig. 4.

## THE "MILLEN-IUM" CONVENTION

Business acumen is to our mind the most applicable expression with which to characterize the recent convention of the staff of John Millen & Sons, and the leading representative men whose various manufactures are embraced under the trade mark "Millen-ium". This conference, the second annual function of its kind, demonstrates unmistakably the benefits derivable from a staff, which, while not only loyal, is in addition, intelligently so. Short talks were given at the business sessions

covering the many trade specialties handled by the firm. These gave salesmen an opportunity of becoming familiar with their product in its every feature, and the wise interspersal of a "question box" and social hour rendered available, later, supplemental and more minutely detailed explanation.

The convention lasted three full days, and its layout gives ample suggestion that "Millen-ium" development and progress for the New Year, 1912, is well on the way to be fulfilled. The headquarters of John Millen & Sons are at Montreal, while branches are established in Toronto, Winnipeg and Vancouver.

## COLLIERY OVERWINDING.

The question of the prevention of overwinding at collieries has been brought prominently to the front of late, and at several of the South Yorkshire pits, ap-

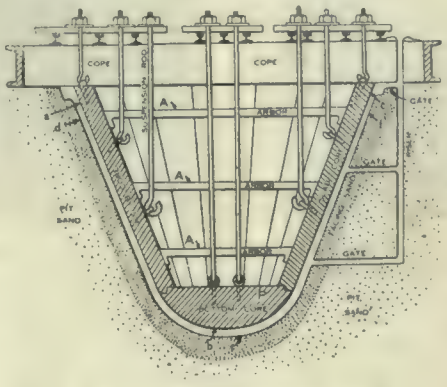



Fig. 5.—Section Through Mold.

pliances for the purpose are already operating. The members of the Midland Institute of Mining, Civil, and Mechanical Engineers, inspected one of these recently, at the invitation of the South Kirby, Featherstone, and Hemsworth Collieries. The Shaw Overwinder, which is installed at these pits, is the invention of the late John Shaw, chairman of the company. It is at work in the winding-house belonging to the Haigh Moor pit, and the visitors saw it tested under ordinary working conditions. It is also being erected in the engine-house for the Barnsley pit.

The gear consists of two nuts travelling in the same direction on a horizontal screw, and each representing one of the cages. It is designed both to reduce the speed of winding and to stop the engine in case the engineman should fail to do either at the proper moment. If he does not reduce speed, the depression of a lever releases a weighted bar, which falls, closing the throttle-valve, cutting of the steam or other motive power, applying the brake, and thus automatically pulling up the engine. A final brake prevents overwinding. Should the gear come into action it can be reset and winding operations resumed within two minutes.

## LEGAL NOTES.

Frank D. Simpson, laborer, Hamilton, Ont., by virtue of a decision in the Divisional Court at Osgoode Hall, Toronto, will receive $400 damages for the crushing of his thumb and fingers in a "tumbler" machine at the works of the Tallman Brass & Metal Co. Simpson alleged that the machinery was defective by reason of the fact that there was no mechanical belt shifter for the belt which operated the machine. Mr. Justice Britton says he finds it hard to believe the plaintiff's story, that he had tried to start the machine with a crowbar and by other means, but had failed, and it was when he had slipped the belt to the loose pulley that it suddenly slipped back to the fast pulley and started the machine, which caught and crushed his hand. This, the judge remarked, was a matter of fact for the jury, which accepted the story.

## MOLDING LARGE SLAG LADLES.

THE Prime Steel Co., Milwaukee, have cast what are believed to be the largest slag ladles ever manufactured. Each ladle is a solid steel casting, and in its production some rather difficult problems in molding and coremaking were successfully solved. The ladle weighs 20,000 pounds and is 10 feet 5 inches diameter across the top, and 8 feet 6 inches deep inside. The capacity is 300 cubic feet. With the exception of the rim, the metal at the top is 1¼ inches thick, increasing to 2¾ inches at the bottom, which is bowl-shaped.

The mold is made in a pit, the ladle being cast right side up. The conical core, which forms the inside of the mold, is suspended from the cope. Fig. 5

shows a cross-section of the mold with the core in place. Fig. 1 shows the cope with the suspended core beneath. In making the mold, the sand is first swept out, forming a cavity exactly the size of the inside of the ladle, and re-

Fig. 1.—Cope with Core Assembled, Before Placing in Mould.

Fig. 2.—Conical Core Slab Suspended.

presented by the line, abc, fig. 5. The core is then assembled in this cavity and the cope finished. The cope with the core is next withdrawn, and the mold swept out again, this time to a size corresponding with the outside of the ladle, as indicated by the line def,

Fig. 3—Ladles after Shaking-out, showing Pouring Gates and Risers.

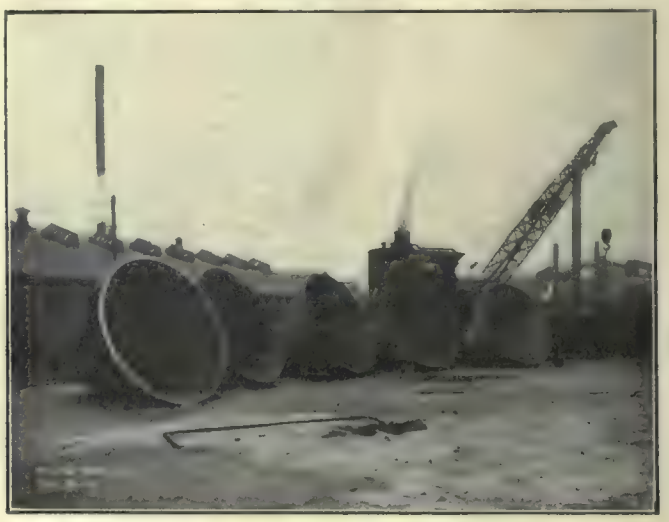


Fig. 4.—Ladles Awaiting Shipment.

fig. 5 The cope and core are afterwards replaced, and the mold finished.

### The Core.

The core is one of the most interesting features of the mold. It is built-up, and consists of 16 separate pieces. Its general construction is indicated in figs. 1 and 5. Referring to these illustrations, it will be noted that it consists of a solid, bowl-shaped bottom piece P, fig. 5, made exactly the shape of the ladle bottom, with 15 wedge-shaped slab cores resting on the bottom piece and forming the conical, inside surface of the mold. The whole core is suspended by rods from the cope. Four 1¼-inch rods carry the bottom core, and each slab core is also provided with three suspension rods, two on the side and one on the top, as indicated in fig. 5.

The slabs, indicated by the cross, fig. 2, are each seven inches thick and 6 feet 3 inches wide at the bottom. They are very strongly made, being heavily reinforced with steel rods and provided with suitable eyes to receive the suspension rods. The bottom piece is also strongly reinforced. Several cast steel arbors, A, fig. 5, are inserted in the hollow conical part of the core to resist crushing stresses.

The cope flask, about 15 feet square and 18 inches high, is made of cast steel with steel cross-bars, and from it this core is suspended. Its sides are similar in cross-section to a rolled channel. Steel rails are laid across the top of the cope, and the washers under the suspension rod nuts rest on these rails, thus distributing the weight of the core. The cope and core together weigh about 20 tons. Great care is taken that the core shall be stiff and able to resist considerable crushing stress and also the upward pressure of the fluid metal in the mold.

The inside of the mold is skin-dried before the cope is replaced. Only one pouring gate is used, as shown in fig. 3. It consists of a riser, about three inches diameter, extending vertically into the sand and provided with three feeding gates, one at the top, one about one-third and one about two-thirds of the distance down the side of the ladle. The gates are about 2x4 inches in cross-section. Six small sink heads are spaced equi-distant around the top of the ladle. The mold was made in the manner described in order to be certain that there would be no cracks or checks in the finished product.

### Casting the Ladle.

The metal is poured from a 20-ton

ladle, and is run into the mold as hot as possible. Ordinary steel is used melted in an acid, oil-burning open-hearth furnace. After the casting has cooled, it is taken out of the mold by the crane, shown in fig. 3. The gates and heads are cut off and the interior and exterior of the ladle smoothed-up with a portable emery grinder.

We are indebted to the Prime Steel Co. for the illustrations, and to the Iron Trade Journal for the descriptive text.

## CANADIAN METAL PRODUCTS CO.

It is understood that Mr. N. Curry, president of the Canadian Car & Foundry Co., will be asked to take the presidency of the new Canadian Metal Products Co. which will be established as a result of the visit which several Montreal gentlemen made to College Point, about twelve miles from the city of New York. They there inspected the plant of the United States Metal Products Co., which has a capital of $8,000,000, and 2,000 men on the payroll. Mr. F. W. Fairman promoted the excursion, which was composed of R. Curry, W. F. Angus, Milton Hersey, J. W. McConnell, Lorne Webster, F. H. Hopkins and Arthur M. Irvine. They returned to Montreal not only satisfied with what they saw at College Point, but decided to establish a plant in Montreal. The new company hope to be in full working order in three months' time.

It is understood that there will be an issue of accumulative seven per cent. preferred stock by the Canadian company, amounting to $500,000, together with $1,000,000 of common, and the statement was made to-day that the preferred stock will be taken by the United States Metal Products Co., which will have a representative on the board.

The machinery to be installed will cost about $150,000, and employment will be given to a large number of skilled hands. The company will manufacture all kinds of metal window frames, doors, etc.; in fact everything connected with the interior fittings of buildings, both large and small.

## LOCOMOTIVE CONVEYING PLANT.

The erecting shop of the Cockerill locomotive works is connected to the station of Seraing by a branch line having curves with a radius of only 50 metres. This is insufficient to permit the passage of the heavy locomotives, types 10 and 36, lately put in service by the Belgian State Railways, as they are unable to round curves of less than 150 metres radius. The erection of an interesting appliance to convey these engines from the works to the station and vice versa, has, therefore, became necessary.

The apparatus consists of two electrically driven elevators of 150 tons lifting power, located one in the works and one at the station of Seraing, and capable of moving a platform bogie wagon on which the locomotive is loaded. The elevators are installed in concrete pits, and their control comprises the operations of placing the empty wagon on the platform, lowering the elevator below the track level, fixing the locomotive on the wagon, lifting the elevator and hauling the loaded wagon to the station, where the inverse operations are performed for placing the locomotive on the railroad tracks. Each of the elevators is fitted with a series wound motor developing 35 h.p., which actuates, by means of a bevel gear system, a transverse shaft driving two longitudinal shafts. These, in turn, by means of mitre-wheels and large nuts in phosphor bronze, give a vertical motion to eight right and left handed screw spindles in forged steel of 112mm. outside diameter. Each of these spindles is capable of sustaining a load of 20 tons, and rests on a thrust-bearing in ferro-concrete. The eight change-speed gears are enclosed in grease boxes fitted with stuffing boxes of special design. The mechanical part weighs about 13,500kg., and was supplied by Messrs. Beer, of Jemeppe-sur-Meuse.

The frame work, weighing about 15,500kg., and constructed by the Ateliers Metaliurgiques of La Sambre, near Charleroi, consists of two plate girders composed each of a web 720 by 12mm., four flange plates 280 by 10mm., and four boom angles 120 by 120 by 12mm., with a height of 765mm. These main girders are supported by four cross girders of the double web box type made of mild steel plates and angles, to which a vertical motion is imparted by means of the eight screw spindles. The elevators are designed for a load of 150 tons, of which 120 tons is accounted for by the load conveyed and 30 tons by the tare-weight of the wagon.

The wagon is carried on bogies each composed of four axles fitted with wheels of 700mm. diameter on the tread; the weight supported by each wheel being 9,375kg. The wheelbase is 11,200 metres, and has been calculated so as to allow the wagon to pass freely over curves of 50 metres radius. The total length of the underframe is 16 metres, the outside breadth over headstocks 2.640 metres, the width of the underframe 1.925 metres, and the height above rail 1.460 metres. The platform is fitted with rails on which the locomotive is pushed; their ends when it is lowered in the pits, fitting exactly those of the tracks. Powerful clamps are provided for securing the locomotive, the wagon being obliged to run over a line having a gradient of 25mm. per metre.—T.E.S.

## COMPENSATION FOR INJURIES.

Compensation for injuries received in an accident at the Edmonton Iron Works in June of this year, was sought in the district court recently, through an action brought against the company by John Petratus, who sustained a broken ankle, while at work in the plant. The proceedings were instituted under the common law, the plaintiff also presenting his claim under the workmen's compensation act, in case the common law suits should fail. Under the first head, Petratus seeks to recover an amount totalling in round figures $400. If the judge should decide that the claim under the common law is invalid, the plaintiff will be able to recover a much smaller amount, probably less than $100, under the compensation law.

Petratus was assisting in the drilling of bolt holes in a steel girder when the accident occurred. Two other men were working in the vicinity and as they lifted a girder from its place, the mass of wrought steel swung around, knocking Petratus from the trestle on which he stood. A heavy I beam fell across his foot, breaking a small bone and incapacitating him for work for some six weeks. He was in the hospital for a couple of weeks, and for a month after his discharge he was unable to work. Finally, he secured a job with the city. His wages were garnisheed by his doctor to the amount of $62.50.

Judge Taylor reserved his decision in the case.

## SUPERHEATED STEAM FOR LOCOMOTIVES.

All the Scottish railway companies have now experimented with superheated steam on locomotives, and have decided that the system is a great improvement. The Caledonian Railway began about two years ago, when they fitted the Schmidt apparatus on a four-coupled passenger express engine. The trials were satisfactory, and four additional engines of the same type were similarly fitted. Now the company are running seven engines with superheated steam, two are being fitted, and four new engines are to be equipped with the apparatus. They have found that the working pressure can be reduced from 180 lbs. and 200 lb. to 160 lb. and 165 lb. In the earlier engines fitted, the cylinders have been increased from 19 in. to 20 in. diameter, while in the later locomotives, the diameter is 21 in.

The North British Railway Co. are

equipping four of their express locomotives with superheating apparatus. Two have been running for some time with the Phoenix or "smokebox" type, and two new 4-4-0 engines, of the "Walter Scott" class will have the Schmidt type. Recently the Highland Railway Co. have built a locomotive fitted with the Phoenix superheater, but it has not yet been in service. The Great North of Scotland Co. are also making arrangements for giving superheated steam a trial.

It is interesting to note, in this connection, that the Scottish companies are restricting the use of superheated steam, for the present at least, to main line locomotives, as they believe that the best results are obtained on long-distance runs.

### CITY OF SOREL, P. Q.

The City of Sorel, Que., 50 miles from Montreal on the south shore of the St. Lawrence, is undergoing considerable expansion and development. In addition, steps are being taken to locate manufacturing plants there, and with this end in view, the City Council is offering exceptional privileges. The water transportation facilities are probably unequalled in Eastern Canada, the city not only being on the direct routes to Europe via the River St. Lawrence, and to the Great Lakes via Lake Champlain, but possessing as well a harbor capable of accommodating ocean-going vessels. There is abundance of cheap labor and electric power, and the council, having retained several good factory sites, are prepared to grant liberal concession. It is confidently expected that as a result of the present movement, Sorel will become one of the leading manufacturing centres in the Province of Quebec.

### COST OF PUBLIC WORKS.

Expenditures on Public Works in Canada last year totalled $11,807,055, according to the annual report just issued by the department. How the figures of outlay have grown is indicated in an interesting corporation table. Twenty years ago the total was $2,711,420. Ten years later it was $4,699,680, and last year it reached five times that of 1891. The expenditure for the twelve months was divided as follows; Harbors and rivers, $2,975,059; dredging plants, $4,471,203; slides and booms, $190,187; roads and bridges, $90,061; public buildings, $3,090,665 ; telegraphs, $568,493 ; miscellaneous, $421,364

The report gives a detailed description of harbor improvements in different parts of the country, and also characterizes as feasible the proposed Saskatchewan river waterway. With the expenditure of a million and a half dollars it is believed that the river can be made navigable for small craft and barges between La Pas and Prince Albert.

### MAY USE OLD STYLE ENGINES.

There is said to be a strong possibility that the Pennsylvania will go back to the old style of passenger locomotive if experiments that are being made continue to give satisfactory results. For some time, the company has been compiling statistics relative to fuel consumption on passenger engines. It is stated that certain of these show a saving in the operation of particular trains, while others do better with heavier hauls. The new engines in use for several years have made good in the matter of speed, but as only some trains require that extra speed be made, the officials believe that those making more stops and operated on a slower schedule can get along very well with the old style engine.

### ENGINEERS' CLUB, MONTREAL.

Mr. J. W. Fraser read a paper, illustrated by slides, at the Engineers' Club, Montreal, on the Southern Power Company's Transmission Lines, which operate in Northern Carolina. In tracing the early stages of electrical transmission, the lecturer mentioned that the Missouri River Power Plant was the first to operate commercially at 50,000 volts, and the Shawinigan transmission to Montreal was put into service a few months later. The Southern Power Company had been organized in 1905 for the purpose of developing certain water powers on the Catawba and Broad rivers. It had been built in sections, and in 1909 a 100,000 volt line of 250 miles was put in service. Since that time, a second circuit had been added and 140 additional miles of two-circuit 100,000 volt lines completed ; a total of 1,380 miles of three-phase line. The greater part of the power was used by cotton mills. At the conclusion of the paper, which the chairman described as one of the most valuable contributions to the electrical section of the club, a short discussion ensued, and thanks were expressed to the lecturer, who, it was pointed out, was an old McGill man.

### NEW SCHOLARSHIP IN ENGINEERING.

Through the generosity of the Boiler Inspection and Insurance Co. of Canada, the department of Mechanical Engineering of the University of Toronto has been made the recipient of a scholarship of the value of the fees of the fourth year. The award is to be made to the student who stands first in honors in the work of the third year in that department. It is to be hoped that the action of the Boiler Inspection and Insurance Co. in this matter may encourage others to take a like interest in the work of the institution. What is here done for mechanical engineering can be done for other departments, and by this means, the bonds between the applied sciences and the industries will be greatly strengthened.

### IRON AND STEEL OUTLOOK.

With the beginning of 1912, fully 100,000 idle workmen will find employment in the iron and steel industries of the United States. Every plant in operation will largely increase its complement of workmen, and scores of mills and furnaces that have been idle will resume output. During January, there will be 237 blast furnaces in operation, as against 211 at the beginning of December. Reports from eastern, western and southern iron and steel concerns, all indicate increased activity with the beginning of the year.

## Personal

Leo G. Smith has resigned his position as general superintendent of the steel foundry department of the Londonderry Iron and Mining Co., Londonderry, Nova Scotia.

Mr. R. B. Coulson, for a number of years selling agent for the Dominion Wire Mfg. Co., has left for Sydney to join the staff of the Dominion Steel Co. After a short stay at Sydney, Mr. Coulson will return to Montreal making his headquarters there. His time will be devoted to the wire products department of the company.

F. A. Yerbury, vice-pres., the Canadian Boving Co., Bay St., Toronto severed his connection with that firm on 31st December. He has accepted an appointment with the Heaps Engineering Co., Ltd., Vancouver, a particularly strong concern who have in project the establishment of large rolling mills, an electric steel making furnace, also a shipbuilding plant, and will manufacture in addition to the products of the foregoing, internal combustion motors for automobile and marine requirements. Mr. Yerbury's name will always be associated with the successful introduction of the Diesel Oil Engine into Canada, and the fact that he has a large personal interest in the Heaps Engineering Co., is sufficient augury of his and its future.

# INDUSTRIAL AND CONSTRUCTION NEWS

...goods will be ...
...m, N. B.—P, M. ...
...ounced ...

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOPS.

**Bridgeburg, Ont.**—Tuttle & Bailey Mfg. Co. will erect a large foundry here in the south ward.

**Welland, Ont.**—The Electro Steel Plant, which has been in the hands of the receiver for some time, has been purchased by C. J. Laughlin and A. M. Mosley. It is stated that a factory for the manufacture of bolts and nuts will be started shortly.

**Winnipeg, Man.**—The Winnipeg Tool & Forging Co. (Geo. F. Fowle and Henry F. Waters) has been dissolved.

**Sherbrooke, Que.**—The city will make a loan of $100,000 without interest for ten years to the Jenckes Machine Co., for the purpose of doubling the plant.

**Kindersley, Sask.**—Messrs. W. J. Hay, S. Pine, C. A. Nugent and G. A. Lucas are opening an up-to-date machine shop and garage here.

**Hamilton, Ont.**—Big additions will be made to the plant of the Steel Company of Canada here. This includes two fifty-ton open hearth furnaces, a 32-inch high blooming mill, a continuing mill and a combination rod and bar mill.

**Newmarket, Ont.**—The ratepayers have passed the by-law to loan the Harding Auto Co., of London, Ont., $25,000, to aid the establishment of a plant here.

**Wingham, Ont.**—The by-law to grant a loan to the Western Foundry Co. was carried by the ratepayers.

**Brampton, Ont.**—The burgesses passed a by-law to loan $43,000 to the Pease Foundry Co., to assist them in locating here.

**Farnham, Que.**—The Pickering Patent Wheel Co. have secured a factory and site, and will locate their plant here.

**Ottawa, Ont.**—The Ottawa Iron & Steel Co. have been incorporated and are planning to expend $150,000 here on a plant. Structural steel will be manufactured, and it is expected that the blast furnaces will be in running order by next summer.

**Edmonton, Alta.**—The Edmonton Iron Works have secured a new site in Riverview, and will move their plant there next summer. It will be enlarged to four times its present size and new departments will be added for the manufacture of new lines of machinery.

**Weyburn, Sask.**—J. A. Shetlah and Jas. Gilmore are opening a new implement firm here to take the place of the defunct Weyburn Implement Co. Besides a line of implements and machinery, they will hold the agency for several makes of automobiles.

**Winnipeg, Man.**—The school board has purchased machinery to the value of $60,796.96 for the machine, forge, foundry and pattern-making rooms of the Kelvin and St. John's Technical High Schools.

**Montreal, Que.**—A small fire damaged the roof of the power house at the Steel Company of Canada recently.

**Brandon, Man.**—A large southern automobile manufacturing concern is in touch with the publicity bureau with a view to locating here. Firms from Ohio and Indianapolis are also in communication.

**Weyburn, Sask.**—A small fire caused slight damage to the Beischel machine warehouse here recently.

**Midland, Ont.**—The Standard Iron & Chemical Co., of Toronto, are negotiating with the town with a view to locating an iron furnace here.

**Port Arthur, Ont.**—The city has signed an agreement with a firm to be known as the Steel Products Co., which now has a plant at Morrisburg, but will move it here and engage in the manufacture of sheet metal.

**Port Colborne, Ont.**—The Buffalo Union Furnace Co. is making arrangements to establish here.

**Niagara Falls, Ont.**—The M. E. Blasier Machine Co., Utica, N. Y., will establish a plant here and manufacture tailors' machines.

**Sherbrooke, Que.**—An iron foundry company are negotiating with the city, and will probably establish a plant here.

**Calgary, Alta.**—The contract for the C. P. R. shops has been sent to the Westinghouse-Church-Kerr Co., N. Y., by Vice-President Bury. They will be the same size as the Winnipeg shops, and if built according to the schedule will be completed by the end of this year.

**St. Thomas, Ont.**—The annual meeting of the shareholders of the C. Norsworthy Co. was held here recently, and on account of the excellent showing it was decided to extend the Howard Furnace business. About $10,000 will be expended on this.

**Toronto, Ont.**—The Schacht Motor Car Co. will erect a $25,000 garage on Richmond Street West here.

**Ridgetown, Ont.**—The R. Watt Machine Co., manufacturers of separators, self-feeders, bean threshers and windmills, are erecting large additions to their present shops.

**St. John, N. B.**—The St. John Railway Co. will hereafter build its own cars, thus adding to the list of important industrial concerns established here.

**Vancouver, B. C.**—The E. A. Heaps Co. are preparing to build a big machine plant near their lumber mills. They will conduct a general machine shop and engineering business.

**Grand Forks, B. C.**—The Granby Smelter has resumed operations, six of the eight furnaces being in operation. They were compelled to shut down because of the loss of their coke supply, occasioned by the recent coal strike. The British Columbia Copper Co. are also reopening their plant.

**Brantford, Ont.**—The Brantford Oven & Rack Co. will build a new factory here.

**Hamilton, Ont.**—The council has passed a by-law granting certain concessions to the Steel Company of Canada, which contemplates making extensive additions.

**Vancouver, B. C.**—G. M. Gibbs, Granville Street, is directing a company that will equip a large new steel mill on the Fraser River, near here.

**Port Arthur, Ont.**—W. J. Lindsay is promoting a company which contemplates establishing here. They will manufacture stoves and heating appliances. A $200,000 plant will be erected.

**Kingston, Ont.**—The ratepayers are being asked to grant a fixed assessment of $100,000 to the locomotive works.

**Napanee, Ont.**—The Dominion Rock Drill & Foundry Co. are asking for a fixed assessment from the town.

**Owen Sound, Ont.**—H. Cole proposes to establish a bolt and nut foundry here, and he is asking for a loan of $20,000.

**Kamloops, B. C.**—Fire did about $3,000 damage to the machine shop of J. W. Ellis & Co. here recently.

**Orillia, Ont.**—The ratepayers are being asked to grant certain concessions to the National Hardware Co.

### MUNICIPAL.

**London, Ont.**—It is proposed to expend $50,000 for an incinerator and plant.

**Exeter, Ont.**—The ratepayers are being asked to sanction an expenditure of $5,000 to extend the waterworks.

**Dunnville, Ont.**—If the ratepayers give their assent, $9,400 will be spent in improving the sewerage system.

**Carleton Place, Ont.**—It is proposed to expend $150,000 for a waterworks system.

**Edmonds, Burnaby, B. C.**—The ratepayers are asked to vote $250,000 for waterworks.

**Ottawa, Ont.**—Plans have been prepared for improvements to the waterworks entailing an expenditure of $2,300,000.

**Barrie, Ont.**—The burgesses are being asked to provide $21,100 for sewerage purposes.

**Hamilton, Ont.**—It is proposed to erect a public convenience here to cost about $18,500.

**Stratford, Ont.**—The city will expend $23,000 extending and improving the waterworks system.

**Saskatoon, Sask.**—By-laws totalling $514,000 for various civic enterprises were passed by the ratepayers.

**North Battleford, Sask.**—The municipality will expend a considerable sum extending the waterworks system.

**Scott, Sask.**—The ratepayers passed four by-laws for sidewalks, water, light and sewers.

### ELECTRICAL.

**Waterdown, Ont.**—The by-law to provide $5,000 to instal a Hydro-Electric power plant has been passed by the ratepayers.

**Kamloops, B. C.**—It is proposed to spend $300,000 for a Hydro-Electric project at Barrier River.

**North Battleford, Sask.**—The ratepayers passed the by-law to expend $94,000 on electric light extensions.

**Brampton, Ont.**—It has been left to the ratepayers to decide whether or not the town will purchase the electric light and power interests of John McMurchy, for the sum of $15,000.

**Paris, Ont.**—It is proposed to expend $25,000 to instal Hydro-Electric power here.

**Petrolea, Ont.**—$6,000 will be spent to complete the Hydro-Electric system.

**Port Credit, Ont.**—The ratepayers are being asked to sanction an expenditure of $7,500 to complete the Hydro-Electric power plant.

**Tillsonburg, Ont.**—The ratepayers are being asked to provide $6,000 to complete the Hydro-Electric system.

**Forest, Ont.**—It is proposed to expend $20,000 on an electric light plant.

**Toronto, Ont.**—Toronto has plans calling for an expenditure of $2,200,000 to complete the Hydro-Electric system.

**Richmond Hill, Ont.**—Steps are being taken to provide $5,000 for electric lighting purposes.

**Renfrew, Ont.**—It is proposed to expend $60,000 for power extensions, etc.

**Woodstock, Ont.**—The ratepayers are being asked to provide $10,000 for lighting purposes.

**Ottawa, Ont.**—The E. B. Eddy Co., of Hull, have planned improvements which will cost upwards of half a million dollars. The projects include the electrification of the whole factory of the company by means of a 1,200 h.p. plant. Water power will be done away with. It will take about two years to complete the improvements.

### BUILDING NOTES.

**Moose Jaw, Sask.**—The Robin Hood Mills, which were wiped out a short time ago by a disastrous fire, will be rebuilt on a larger scale than ever.

**Vancouver, B. C.**—The London and British North America Co. will erect a $250,000 nine-storey building here at once. Somerville & Putnam are the architects.

**Montreal, Que.**—Johnson Bros., jewelers, will next May erect a five-storey building to cost $150,000. It will be of steel and concrete.

**Toronto, Ont.**—Messrs. H. H. Macnamara and H. Gagnier have been granted a permit for a $100,000 office building at the corner of Richmond and Sheppard streets.

**Winnipeg, Man.**—Messrs. Burke, Horgood & White, architects, of Toronto, are preparing plans for a $2,000,000 departmental store to be erected here for the Hudson's Bay Co.

### PLANING MILL AND SAW MILL.

**Red Deer, Alta.**—Cushing Bros., owing to their growing business at this point, propose building a new sash and door factory here next spring. Seven or eight machines will be installed.

**South Vancouver, B. C.**—The building inspector has issued a permit to the Coast Lumber & Fuel Co. for the erection of a lumber mill; and also one to the South Vancouver Lumber Co. for a mill at Fraser River, the latter to cost about $12,000.

**Victoria, B. C.**—The Canadian Puget Sound Lumber Co. are about to make a large addition to their mill plant here. They will erect a three-storey building at a cost of $40,000. Other improvements are now under way.

**Toronto, Ont.**—Fire did $45,000 damage to the planing mill of the William A. Dunn Lumber Co. here.

**South Vancouver, B. C.**—Robert Nesbitt, a Vancouver real estate broker, is promoting a company that proposes to establish lumber yards here. $25,000 will be invested.

**St. Marys, N. B.**—Wm. H. Gunter has purchased the Babbitt estate mill here. The new owner will assume active management next season.

**Red Deer, Alta.**—E. Rivard, of Calgary, has secured a site in North Red Deer, where he and two partners will build a sash and door factory.

**Port Hammond, B. C.**—The mill of the Bailey Lumber Co. is about to commence operations once more. New machinery is being installed and several extensions will be made to the plant.

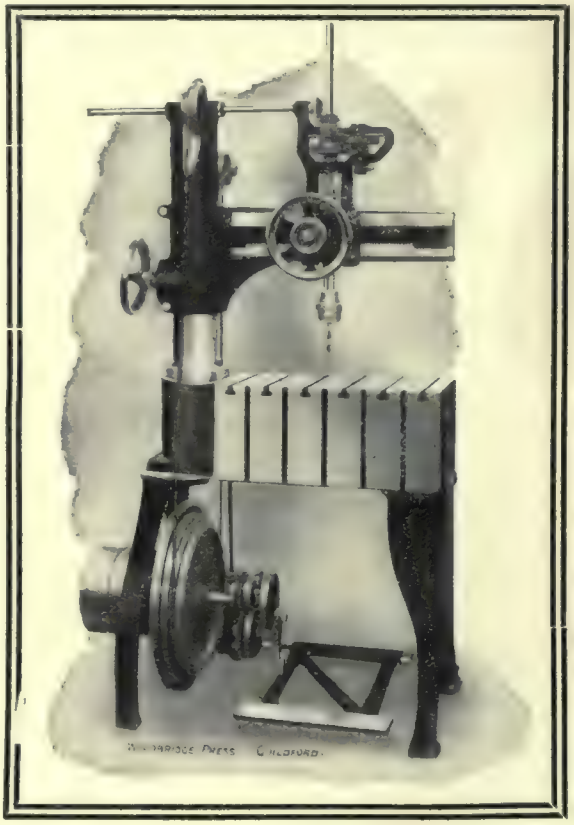
### GENERAL MANUFACTURING.

**Midland, Ont.**—There is a proposition on foot here to grant a fixed assessment to J. A. Benson and M. J. Bray, to assist in the establishment of a woodworking plant here.

# A Radial Drill

that will by foot power drill holes up to one inch without a pilot hole, at the speed of an inch in six minutes; with the slotted wings for awkward work; inexpensive, but one of the most useful tools ever designed.

This tool is the only really effectual foot drill on the market.



A tool that will earn its cost many times over. :: :: ::

| | | | |
|---|---|---|---|
| Surface of Table Top, | 23″ x 12″ | Sensitive movement, | 4¼″ |
| Surface of Wings, - | 23″ x 10″ | Radial movement of arm, | 120° |
| Travel of head on arm, | 18″ | Height over all - | 5′ 10″ |
| Arm will rise and fall, | 6″ | Weight - - | 720 lbs. |

**The Price is $108** at works in England

**AGENTS.** WE ARE LOOKING FOR FIRMS WILLING TO TAKE UP AGENCIES. WRITE TO

## DRUMMOND BROS., Limited

**Reid Hall, Guildford, Surrey, England**

*The advertiser would like to know where you saw his advertisement—tell him.*

**Orangeville, Ont.**—The ratepayers are being asked to grant a loan of $3,000 to aid a novelty manufacturing concern to establish here.

**Waterloo, Ont.**—Snyder Bros. are building a new furniture shop heer at a cost of $15,000. Upholstered goods will be manufactured.

**St. John, N. B.**—P. M. Black, of Portland, Me., announced recently that a factory is to be established here for the manufacture of Blockite, an explosive to take the place of dynamite.

**Regina, Sask.**—It has been reported that a large eastern firm will establish a soap factory here in the near future.

**Halifax, N. S.**—Fire destroyed the boiler house of the Carritter, Paterson Mfg. Co.'s roofing paper works at Fairview recently.

**New Westminster, B. C.**—The Dominion Match Co. have secured a site here, and will erect a $75,000 plant. It will be 200 x 60 feet.

**Montreal, Que.**—It has been announced that Swift & Co. will locate here, and erect a big storage plant. This will necessitate the installation of a refrigeration plant.

**Toronto, Ont.**—Scythes & Co. have purchased a factory on Macdonnell Avenue for $13,000.

**Ottawa, Ont.**—The publicity commissioner has received a communication from a firm of cut glass manufacturers, who intend opening here shortly.

**Guyon, Que.**—Fire did $10,000 damage to the Dawd Milling Co.'s mill here recently.

**St. Aandrews, N. B.**—The Canadian Sardine Co. will erect a large plant at Chancook, near here. G. F. Johnson, of Montreal, is the president.

**Chatham, Ont.**—D. A. Gordon, of Wallaceburg; Gilchrist, of Detroit, and, Alpena, Smith, of Bay City, and Averey, of Detroit, propose establishing a sugar beet factory here. The plant, if erected, will be one of the largest in the Dominion, having a capacity of 1,000 tons per day.

**Kingston, Ont.**—The Commercial Box & Envelope Co. are asking certain concessions from the city, to aid them in establishing here.

**Wallaceburg, Ont.**—The town is being asked to grant aid to the Wallaceburg Glass Co., by extending a loan of $20,000.

**Kincardine, Ont.**—The Andrew Malcolm Furniture Co. are asking for partial tax exemption to assist them in locating their industry here.

**Mount Forest, Ont.**—The ratepayers carried the by-law to aid the Carriage Co. by granting a loan of $14,000.

**Oakville, Ont.**—The tax exemption by-law in favor of the Ware Mfg. Co. was carried by the ratepayers.

**Granby, Que.**—The burgesses carried the by-law to loan the Granby Hardware Co. the sum of $5,000.

**Calgary, Alta.**—The Flesher Marble Co. will erect a plant here.

**Toronto, Ont.**—W. B. Levack is about to erect a $13,000 tannery here.

### THE AMERICAN ABELL CO.

**The M. Rumley Company, of Laporte, Indiana,** has purchased the stock and assets of the American Abell Co., of Abell street, Toronto, for a sum slightly in excess of two million dollars. The purchasers will continue to carry on business here under the American Abell name, but will in the near future double the capacity of the plant, which they have acquired to get entrance into the Canadian agricultural machinery market. The American Abell Co. is incorporated under Ontario laws, and has an authorized capital of $1,000,000, of which $700,000 has been issued, consisting, it is understood, of $500,000 common stock and $200,000 preferred.

### THE PARSONS TURBINE IN CANADA.

**Mr. J. P. Stockbridge,** who represents G. S. Parsons & Co., Newcastle-on-Tyne, is visiting various parts of Canada in the interests of their turbine which has such a wide application for driving generators, ventilating fans, etc. Mr. Stockbridge has recently been engaged in the installation of many large Parsons turbine plants in Australia. One of the principal results of his present visit has been the placing of the sole Canadian agency for these turbines with the Robb Engineering Co., who will also manufacture certain parts. The Robb Engineering Co., with offices in the principal cities of Canada, are the well-known contractors for the complete equipment of central power stations, collieries, steel works, etc.

### THE CANADIAN ELECTRIC WELDING CO., LTD.

A company to be known as the **Canadian Electric Welding Company, Ltd.,** has recently been organized. The capitalization is $500,000, and the headquarters in the Bank of Ottawa Building, Montreal. It owns and will operate in Canada, the patents covering spot or point


BUILT ON THE MOST SUBSTANTIAL LINES TO WITHSTAND THE RACKET OF

Continuous Hard Service

12" to 30" Heavy Type Floor Grinders
12" to 20" Heavy Type Water Tool Grinders
Power Hack Saws
Universal Swivel Tables for Drill Press, Shaper, etc.

GET OUR PRICES
DELIVERY FROM STOCK

THE FORD-SMITH MACHINE COMPANY
HAMILTON, ONTARIO

BRONZE-ALUMINIUM-BRASS-MANGANESE
CASTINGS
Why pay for bad castings and the machining cost on them? Our castings are right, and scientifically made.
Lumen Bearing Company
WESTON ROAD and C.P.R. · TORONTO, ONT.

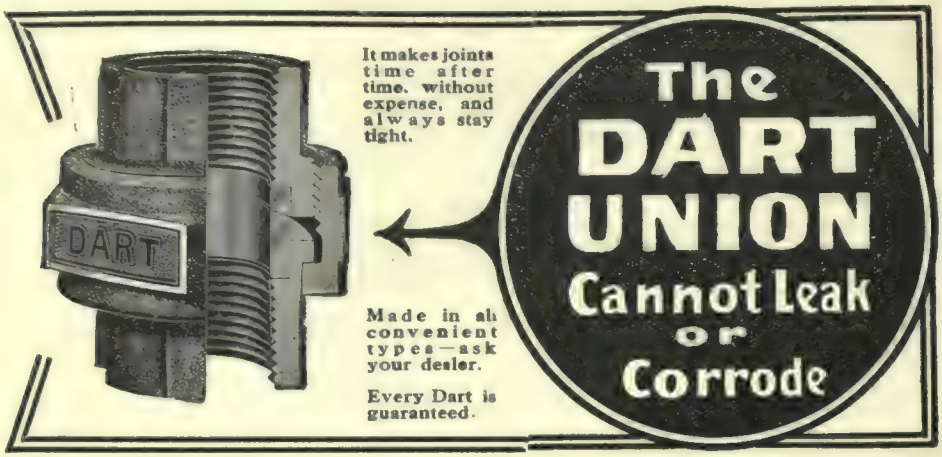
Jessop's Best Tool Steel is yet unexcelled for cutting tools of all kinds, and for general machine-shop use.

Jessop's "Ark" High-speed Steel gives marvellous results—heavy cuts -- at rapid speed; cannot be burned.

The favorite brands with users of good steel.
A large assortment of sizes in stock.
Jessop's high-grade files and rasps.

Manufactured by WM. JESSOP & SONS, Ltd. Sheffield, Eng.

Reid Newfoundland Co. St. John's, Newfoundland
Alex. Woods 138 Murray Street Montreal, Que
Chas. L. Bailey 80 Bay St. Toronto, Ont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It makes joints time after time, without expense, and always stay tight.
Made in all convenient types—ask your dealer.
Every Dart is guaranteed.
The DART UNION Cannot Leak or Corrode

# Cutting Crucible Costs

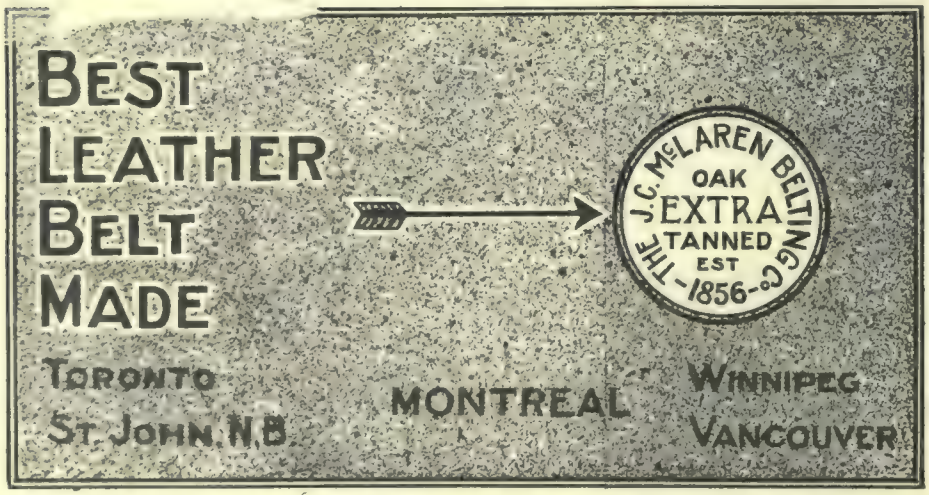
Cost and price are distinct terms.

## DIXON'S CRUCIBLES

are less costly because of the service you get out of them. They give more heats and more general satisfaction than you usually get from crucibles.

WRITE FOR BOOKLET ***No. 223-A.***

**Joseph Dixon Crucible Co. - Jersey City, N.J.**




## SCREWS THAT ARE THREADED TWICE

ARE THE KIND YOU WANT.

**More Likely to be Accurate.**

"MORROW" Set and Cap Screws are threaded twice. (Two dies over each screw).

Makes Morrow make uniform.

DON'T ALLOW ANY FIRM TO SELL YOU INFERIOR MAKES.

**The JOHN MORROW SCREW, Limited, INGERSOLL**

welding of the Universal Electric Welding Co., New York, and the Thomson Electric Welding Co., Lynn, Mass. The vice-president and general manager, A. M. Irvine, is well known as the late managing director of the Parker Foundry Co., Montreal, and the other directors of the company are:—Robert Hobson, vice-president of the Steel Company of Canada; W. W. Butler, vice-president of the Canadian Car & Foundry Co.; C. W. Kinsella, contractor, New York, and A. J. Nesbitt, Montreal. With the unlimited possibilities for electric welding, and with the strong baord which this company has secured, it will no doubt attain a high degree of success in its undertaking.

### TRADE NOTES.

**The Robb Engineering Co.** have recently sold return tubular boilers as follows: One 48 in. x 12 ft. to Albert Fraser, Clementsvale, N.S.; one 42 in. x 10 ft. to Frank L. Irving, Billtown, N.S.; and a 42 in. x 10 ft. heating boiler to Gorman, Clancey & Grindley, Edmonton, Alta.

**The Goodyear Tire & Rubber Co., of Canada, Ltd.,** have just completed a very large addition to their factory at Bowmanville, Ont. It involved an expense of $170,000, which includes a new three storey building and additional machinery. This will greatly increase their capacity for the manufacture of Rubber Goods. The difficulty in the past year has been that their previous factory equipment was not sufficient to keep up with the orders which were received. Special machinery of the latest and most modern type for the manufacture of Mechanical Rubber Goods has been installed. The large Hose room is so constructed that there are no posts to obstruct the working of the overhead carriers. The labor question has been a serious one, especially due to the fact that there was no accommodation for help. It has been decided to build about sixty workmen's cottages; 26 of these being now under construction, and more will be added as soon as possible.

**The Youngstown Sheet and Tube Co., Youngstown, Ohio.,** has recently placed an order with the **Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa.,** for a total of 99 motors to be used in connection with their open hearth plant. They will be used on cranes, charging machines, strippers, transfer tables, screw downs and blooming mills. The Youngstown Company formerly used the Bessemer Process, and is now installing the open hearth process and blooming mill for taking care of the open hearth process output. An interesting point of this order is that 56 of these will be the new Westinghouse M.C. direct-current mill type motor, equipped with commulating poles. This line has been designed to parallel the well-known M.T. alternating-current motor which has proved so successful in mill service.

**The Hamilton Facing Mill Co., Hamilton, Ont.,** have recently sold and installed cupolas at the following plants:—The Waterous Engine Works Co., Brantford; The Canadian Yale & Towne Co., St. Catharines; The Kerr Engine Co., Walkerville, and that of Thomas B. Angrove, Kingston, Ont.

**The Smart-Turner Machine Co., Hamilton, Ont.,** report the following orders recently received:—Messrs. Parke, Blackwell & Co., Toronto; Independent Jet Condenser, The Hollinger Gold Mines, Ltd., Aura Lake, Porcupine; Automatic Feed Pump & Receiver, The Royal Ice Cream Co., Welland, centrifugal pump; The Niagara Brand Spray Co., Trenton, duplex ball valve pump; Messrs. Price Bros. & Co., Jonquiere, P.Q., two power vacuum pumps; New Brunswick Pulp & Paper Co., Millerton, N. B., duplex pot valve pump; The Dominion Government, two vertical duplex donkey pumps; The Davis Leather Co., Newmarket, duplex pump; The Alabastine Co., Caledonia, duplex double acting power pump; The Foley-Rieger Pulp & Paper Co., Thorold, centrifugal pump.

### POWER PLANT DEVELOPMENTS.

#### BRITISH COLUMBIA.

**Kamloops.**—Superintendent C. L. Wain reports as follows on enlargment and additions to power plants:—A new pump is required, capacity 2,000,000 gals. a day. Recommendation was made for a 2,000,000 gallon reservoir with a 14-inch supply pipe. Total cost of installation was estimated as follows: Turbines, pumps, boilers, etc., $53,150; pipe line, gates and valves, $23,701; reservoir (1,000,000 gals.) $19,132.92; reservoir (2,000,000 gallons) $31,276.17. Total cost with reservoir of one million gallons, $95,983.92. Total cost with reservoir of two million gallons, $108,227.47.

#### MANITOBA.

**Winnipeg.**—Tenders will be received until January 22nd, 1912, for the supply of one 250 k.w. exciter motor generator set, with accessories complete, and spare parts, to be

erected on foundations supplied by the corporation in the power house, Point du Bois. Further instructions may be had at the office of the Power Engineers, Carnegie Library Building, Winnipeg.

### ONTARIO.

**Sault. Ste. Marie.**—The Lake Superior Power Co. have awarded the contract to Chapman & Walker, Toronto, for the supply of electric motors, amounting to 3,000 h.p., and costing $30,000.

**Carleton Place.**—On January 1st a by-law to raise $200,000 for a waterworks system was voted on.

**Kincardine.**—An extension to the filtration system is proposed, and the engineer is instructed to report on present system and cause of scarcity of water.

**Ottawa.**—A by-law will be submitted to endorse an expenditure of $2,300,000 to bring water from McGregor's Lake.

**Hamilton.**—The city will apply for permission to borrow funds as follows: Water mains, $74,469; check valves, $3,000; new shops, $1,000; bench pump house improvements, $1,000; new high-pressure boilers at Burlington Beach, $12,000; meters, $6,000; new conduit, $8,861; high-level reservoir improvements, $4,500; new services, $10,000; mountain pump house improvements, $500; piles at intake pipe, $800; new hydrants, $1,000. Total, $123,130.

**Ottawa.**—An artificial ice plant is to be installed in connection with the Chateau Laurier before the building is completed. The plant will be situated in the rear of the Grand Trunk station and will provide ice for both the station and the hotel. The architects, Ross & MacFarlane, say that the plant will be ready for operation as soon as the hotel is completed.

**Ottawa.**—Three rapids in the St. Lawrence River entirely on Canadian territory, the Cedars, Cascades and Coteau, are to be developed for water purposes, by an English syndicate. The promoters will capitalize their enterprise at $100,000,000, with a charter from the Dominion Government.

**Brantford.**—The Brantford Cold Storage Co. will equip a new plant.

**Tavistock.**—The work upon the new waterworks for the town having been practically completed, an exhaustive test was made recently by F. W. Farncomb, C.E., of London, who designed and supervised the construction of the system. The hose was attached to the hydrants at various points, and in every instance, the results were most satisfactory. Without using the pumps a uniform pressure of over 50 pounds was secured from the 50,000-gallon elevated tank. This will be the constant domestic pressure. With the pumps in operation a pressure of 115 to 125 pounds was maintained. This pressure will only be used in case of fire. The steam pumps, which were supplied by the Canadian Fairbanks Company, have a capacity of half a million gallons each, and are abundantly supplied from two large overflowing artesian wells to the north of the town. The water is conveyed by gravity to the pumphouse, from whence it is lifted through the pumps into a steel tank elevated to a height of 120 feet. In case of fire the tank may be cut off and the water forced directly into the mains. Automatic relief valves are connected with the mains, so that with both the powerful pumps in operation, should the fire hydrants be closed, the pressure will not exceed 100 pounds. The water mains, which were laid by Messrs. Craig & Geary, of London, developed no leaks under the pressure.

### QUEBEC.

**Montreal.**—The power house and electric supply station of the Saraguay Electric Co. was visited by fire recently. The fire, it is believed, had its origin in the boiler room, which is separate from the station proper, but soon made its way to the latter building. Both structures were badly damaged. The buildings were erected in 1904. They are of concrete and cement construction, the only woodwork being some interior fittings. The capacity of the Cartierville plant is 30,000 h.p., and many of the new wards of the city depend on this plant for electrical energy in connection with street lighting.

**Quebec.**—Municipal lighting and erection of a steam plant, etc., will be rushed in Quebec, and probably new machinery installed for extra power at the dam at Dorchester, 15 miles from here. Contractor, The Dorchester Electric Co., of Quebec.

**Montreal.**—In connection with installation of pumps for the sewage disposal plant here, the following are the tenders submitted:—John McDougall, Caledonian Iron Works, $29,300 and $30,400; Chapman & Walker, $23,100 and $24,500; John Inglis Co., $25,300; Canadian General Electric Co., $22,600; Laval Steam Turbine Co., $37,000. In the case of Chapman & Walker and John McDougall,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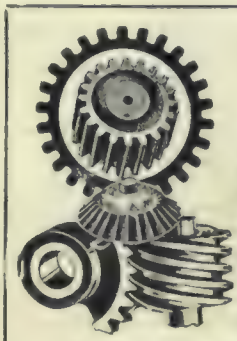

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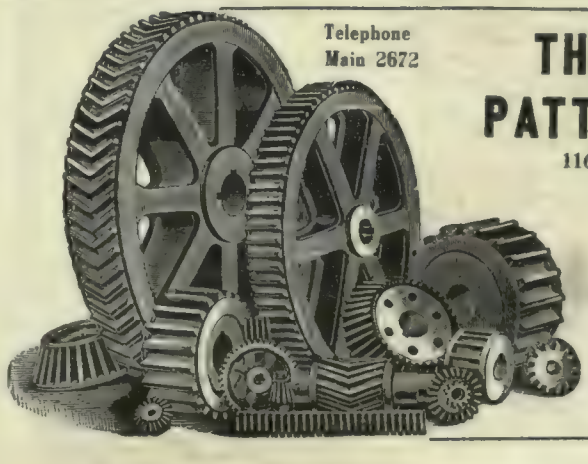

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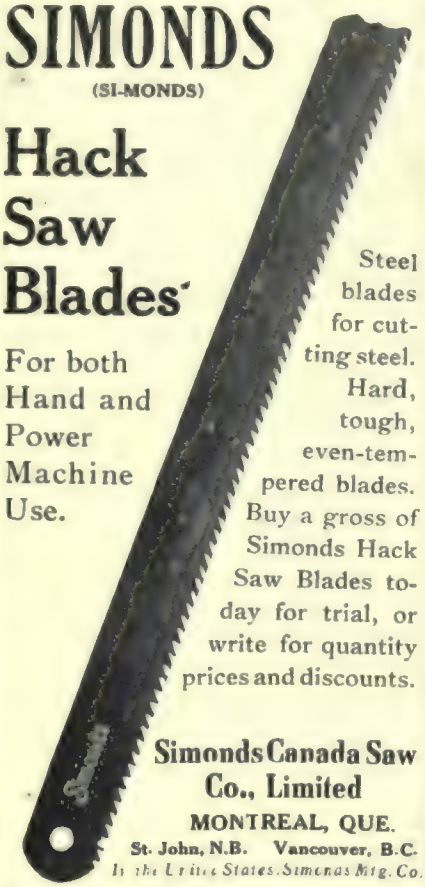

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Caledonian Iron Works, two separate types of pumps were quoted on.

**Montreal.**—Following the completion of its freight yards at the Place Viger station, the C. P. R. has now begun work on the laying out and construction of another huge freight terminal for Montreal to take care of most of the work now done at the terminals at Outremont. The new yards are to be situated some distance west of Montreal, and the name of the station, it has been decided, shall be Sortin. Announcement was made that the contract has been awarded for the construction of a 24-stall engine house, machine shop, turntable, coaling plant, stores and rooming and lodging building, the latter capable of accommodating 100 men. The new yards will have an initial capacity for 2,000 cars and eventually that for 4,000, and will be among the largest and most complete in the Dominion. They will save a haul on the traffic, as compared with the Outremont yards, of 20 miles.

**Montreal.**—A check, the amount of which was not disclosed, passed recently from the officials of the Canadian Light, Heat and Power Co. to those of the Saraguay Electric and Water Co., thus closing a deal which has been on the tapis for some time past. The Saraguay Company was brought into official existence in the year 1906, the capital being authorized to the extent of $3,000,000, and it is stated that the amount expended on the plant amounts to close on to three-quarters of a million dollars. It has over six hundred customers within the city limits, and about 1,600 in all, so it will be seen that a formidable clientele has been transferred to the Canadian Light and Power Co. The latter also acquired control of the Central Heat, Light and Power Co. last spring.

**Montreal.**—The contract for the installation of the first two units for the development and transmission to Montreal of 40,000 h.p. of electrical energy from Carillon Falls has been given to the Carillon Construction & Development Co., Montreal, by the National Hydro-Electric Co. The work of this contract began on November 20th.

**Montreal.**—The Bishop Construction Co., Montreal, has ben awarded the contract for the construction of the dam power house of the hydro-electric power plant on the Magog River at a cost of $125,000. T. Pringle & Son, Ltd., engineers and architects, 419 Coristine Bldg., Montreal.

**Lake Megantic.**—The Lake Megantic (Que.) Pulp Co. will buy turbine engines for a new power plant to be built on the Chaudiere River, at Lake Megantic.

### NEW BRUNSWICK.

**Edmundston.**—The town of Edmundston recently inaugurated its electric plant, when Mayor A. Dugal, in the presence of the aldermen of the town and Pius Michaud, M.P., turned on the electric current. The generating station for both the water and the electric plants with capacity of 450 h.p., is situated on Green River, ten miles north of Edmundston, and consists of a dam 400 feet long and 28 feet high, a power house with two sets of twin water wheels and two electric generators. It can supply sufficient power for water distribution and electric lighting to a population of at least 10,000 inhabitants. The streets are lighted with 150 tungsten lamps, each having a capacity of 65 candle power. The capacity of the steam pump is 700 gallons per minute, and that of the electric pump, 1,200 gallons to the minute. On the highest point of the town is located a steel stand pipe 35 feet in diameter and 50 feet high, having a capacity of 35,000 gallons which gives a natural water pressure of 125 pounds. Forty-four hydrants for fire protection are distributed over the town.

### CATALOGUES.

**Circular 1198, describing Alternating-Current Water-Wheel Generators** has been issued by the **Westinghouse Electric and Manufacturing Co., of East Pittsburg, Pa.** The publication illustrates and describes the different types of generators, both vertical and horizontal, for water-wheel drive, manufactured by that company. It appears that the Westinghouse Company has several different types of rotor construction each of which is adapted for a certain rotor diameter and speed range. These types of construction are described in considerable detail. Other components of the water-wheel generators are given attention and many pictures of installations are shown. Numerous illustrations of water-wheel driven installations are shown.

**Plastics, Ltd., Van Horne St., Toronto,** have sent us a copy of their Catalogue E-F in which are listed their well-known Bakelite discs for globe valves and Bakelite pump valves. Bakelite is a new product that cannot

steam or chemicals and is meeting with much success.

**Fyfe, Wilson & Co., Glasgow, Scotland,** have sent us their Bulletin No. 112, which describes the Kelvin gasoline and kerosene-driven electricity generating sets. These have been designed for use in lighting farm and country houses, hotels, etc. In the Kelvin set, the engine is direct connected to the dynamo, the whole being mounted on one bed. The four-cycle or Otto principle has been adopted. The engine is fitted with the Bergins starting device, by means of which starting up without vigorous cranking is accomplished. Each generator set includes a storage battery of sufficient capacity to carry the lighting load under normal conditions for several days at a time—even during the darker season of the year. It is, therefore, only necessary to run the engine once or twice a week for a few hours. The various sets mounted on wooden trucks, with four small wheels, are readily portable by hand or horse haulage. The sizes vary from 3 to 16 kw.

**Veritys, Ltd., Aston, Birmingham, England,** have sent us illustrated price lists of their English-made Tungsten lamps, and also of their Aston Farm House lighting sets. These consist of a gasoline engine and a dynamo direct-coupled and mounted on one base. An accumulator and switchboard complete an outfit, which it to be recommended on account of its easy portability. These sets are supplied in six sizes, suitable for from 28 to 225 lamps of 20 watts. Prices are quoted in Canadian currency, and are very reasonable.

**The Vincit Company, Ltd., 70 Queen Victoria St., London, E.C., England,** have issued a catalogue of their carborundum and electrite grinding wheels, hones, discs, powders, etc. Carborundum, of course, needs no description. Electrite, another product of the electric furnace, is claimed to be particularly suitable for grinding steel, brass, copper, gun metal, malleable iron, etc.

**The Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa.,** have sent us their circulars No. 1028 and 1190. The first illustrates and describes numerous examples of rotary converters, while the second deals with type E engine-driven A. C. generators.

**The Allis-Chalmers Co., Milwaukee, Wis.,** have forwarded a copy of their Bulletin No. 1083, setting forth the distinctive features of their D. C. generators and showing numerous examples of their application to the direct driving of machine tools.

**The Wirt Electric Specialty Co., Germantown, Penn.,** call attention in Bulletin 1106, to their various types of electrical resistance units, which are insulated with a patented material known as "Di-el-ite."

**The Canadian Gasket Co., Bridgeburg, Ont.,** send us their price list of gaskets. Among other types listed are plain and corrugated copper gaskets, those with asbestos cord-filled corrugations, smooth copper gaskets with asbestos filling, lead gaskets for ammonia fittings, oval gaskets for man-holes, hand-holes, etc.

**Poetter, G. M. B. H., Ltd., Dusseldorf, Germany,** have sent us a copy of their latest catalogue of gas producers, constructed on the Hilger system. These producers have a slowly rotating ash pan and a star shaped grate. Through the rotation of both of these the ash in the producer is kept constantly in motion, thus preventing formation of clinker. Moreover, by these means new surfaces of the fuel are being constantly brought under the influence of the blast, with the result that gasification is greatly hastened. A gas producer of 10 feet internal diameter is claimed to be capable of dealing with 25 long tons of coal or 36 tons of lignite per 24 hours.

**Veritys, Ltd., Aston, Birmingham, England,** have sent us their List No. X149, which describes handy farm house lighting sets, consisting of a dynamo and gasoline engine direct-coupled and mounted on one base.

**The Lunkenheimer Co., Cincinnati, Ohio,** has recently issued an attractive booklet describing their various types of blow-off valves, and they will be pleased to send it upon request.

**The Keuffel & Esser Co., New York, and Montreal,** have mailed us their latest price list of flat wire tapes and band chains for the use of surveyors, contractors, etc.

**George Swift & Sons, Halifax, England,** have favored us with a copy of their new catalogue No. 151, which deals with the high speed engine lathes manufactured by this firm. These are at present made in four sizes: 7, 8½, 10 and 12½-inch. The 7-inch lathe has a cone drive, and the others can be supplied with cone drive or all-geared motor-driven head, if desired. The designs are thoroughly up-to-date, and prospective pur-


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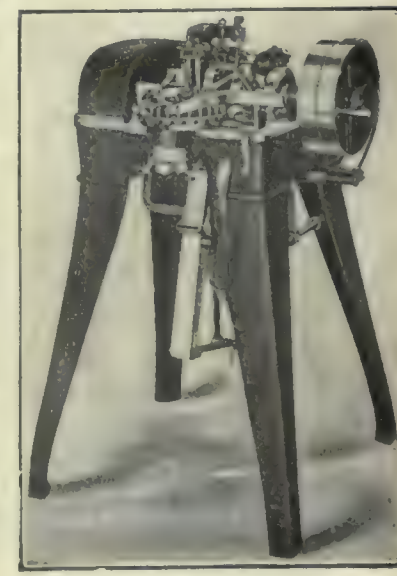

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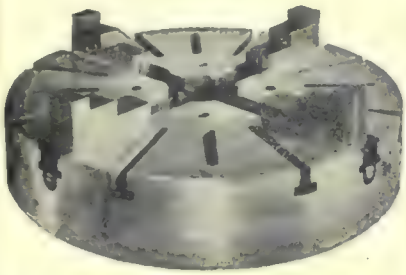

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chasers should have the firm's catalogue on file.

**The Allis-Chalmers Co., Milwaukee, Wis.,** have forwarded a copy of their Bulletin No. 1083, setting forth the distinctive features, and showing numerous examples of the application of their D. C. generators to the direct driving of machine tools.

**The Hendey Machine Co., Torrington, Conn.,** have brought out a booklet entitled, **"Helps on Change Gearing and Thread Cutting for Users of Hendey Lathes,"** which they will be glad to send to all operators and purchasers of their lathes.

### CATALOGUES RECEIVED.

**A. A. Jones, Pollard & Shipman, Leicester, England,** have sent us their latest catalogue of machine tools. These include high speed drilling machines from 20 up to 30 in. swing, milling machines, drill grinders, tool and cutter grinders, power hack saws, arbor presses, etc., etc. Many of the lines have been specially brought out to meet competition on the Canadian market, and the designs appear to be thoroughly sound. The makers guarantee the accuracy of their sensitive drills to .001-inch, and of their upright geared drills to .002-inch. Users of machinery would be well advised to send for this catalogue, more especially as the prices quoted are most attractive.

**The Kearney & Trecker Co., Milwaukee, Wis.,** have brought out Catalogue 18, dealing exhaustively with the well-known Milwaukee milling machines. The catalogue is a high-class production, and contains a large amount of useful information concerning the construction, upkeep and operation of these products. Tool room and machine shop foremen, etc., can secure a copy on application.

### BOOK REVIEWS.

Under the title "Technology and Industrial Efficiency," the proceedings of the Congress of Technology, held in Boston last April, at the Massachusetts Institute of Technology, have been published in a volume of about 500 pages. Some seventy papers are included, and these form a valuable and up-to-date record of the present state of industrial science, together with a presentation of some of its problems and probable solutions. The six sections, into which the congress was divided, are represented by papers on: Scientific Investigation and Control of Industrial Processes; Technological Education in its Relation to Industrial Development; Administration and Management; Recent Industrial Development; Public Health and Sanitation; Architecture.

**A Short Course in the Testing of Electrical Machinery,** by J. H. Morecroft and F. W. Hehre, New York, D. Van Nostrand Co.; price $1.50. This book has been written primarily for the use of engineering students who are not specializing in electrical work, but who nevertheless desire to obtain some knowledge of testing. There are many operating engineers desirous of obtaining a knowledge of theory to whom this book should prove useful.

**The "Mechanical World" Electrical Pocket Book for 1912;** Emmott & Co., 65 King Street, Manchester, England; price 12 cents. Various improvements have been made in the latest edition of this popular little handbook. The matter devoted to lighting has been entirely re-written, and is now presented in two sections, one dealing with electric lamps, and the other with electric lighting. A new section on motor starters has been introduced, and another on static transformers. The book throughout has been generally revised, and as usual is worth many times the low price asked for it.

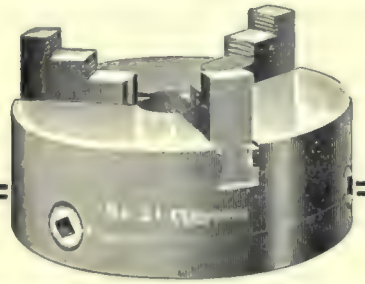
**Bulletin No. 48, "Resistance to Flow Through Locomotive Water Columns,"** by Arthur N. Talbot and Melvin L. Enger, records the results of tests of fourteen of the principal forms of locomotive water columns or cranes in use on the railways of the United States. Besides giving the loss of head at various rates of discharge, the tests provide data on the hydraulic characteristics of the valves. Water hammer, relief valves, friction losses through pipe lines, and methods to be used in the design of water service installations are also considered. The bulletin should be of interest to motive power and maintenance of way men. Copies of this bulletin may be obtained gratis upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

**"Tests of Nickel-Steel Riveted Joints,"** by Arthur N. Talbot and Herbert F. Moore has just been issued as Bulletin No. 49 of the Engineering Experiment Station of the University of Illinois.

The use of nickel-steel in the construction of bridges of great span is one of the interesting recent developments in the field of engineering. For many years it has been known that an alloy of nickel with steel possessed great strength and toughness, and hence nickel-steel has been extensively used as armor for battleships, and in other structures where the necessity for great strength was paramount.

To the casual observer, a steel bridge seems to be a rigid structure, but the engineer knows that microscopic movements of parts are constantly taking place as the bridge is exposed to wind, to heat and cold, or to the moving load of a passing train. There is no doubt that the use of nickel-steel would make possible the reduction of the weight of steel required to build a bridge, but the action of the riveted joints of the bridge, if nickel-steel were used, has not been known.

In considering designs for a new bridge over the St. Lawrence river, near Quebec, Canada, which is to replace the bridge that collapsed during the erection, the Board of Engineers of the Quebec Bridge, appointed by the Canadian Government, requested the Laboratory of Applied Mechanics of the University of Illinois to undertake a series of tests of nickel-steel riveted joints.



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# Illustrated Description of the Johnson Stock Gang

*The Writer of this Article, Who by the Way is also the Designer of the Machine, Shows the Successful Outcome of a Complete Departure from Standard Practice, in Layout and Detail of this Important Accessory of the Saw Mill and Lumber Industry. Needless to Say, the Complete Mechanism is at Once a Tribute to Canadian Genius and Constructional Ability.*

**UNUSUALLY HEAVY STOCK GANG OF NEW DESIGN.**

By Geo. H. Johnson.

DURING the season of 1909, the writer received instructions to develop a machine that would increase the output and improve the quality of the cut in our No. 3 mill. It was somewhat reluctantly decided to build a heavy machine of untried design, and only after having investigated the record and performance of all the standard stock gangs of Canadian, American and Swedish design; because none of these machines were suited to our needs.

Some of the conditions the new machine would have to fill were very exacting:—

(1)—An output of 225 thousand feet in 10 hours when cutting two by twelve white pine.

(2)—Feed necessary to obtain above output not to exceed 9-16 inch per revolution.

(3)—No oak or timber of any kind to be used in foundation or machine design.

(4)—Machine to be rigidly rock bolted and placed on solid concrete.

(5)—Revolutions per minute not to exceed 260 in order to assure necessary output.

**Outstanding Features.**

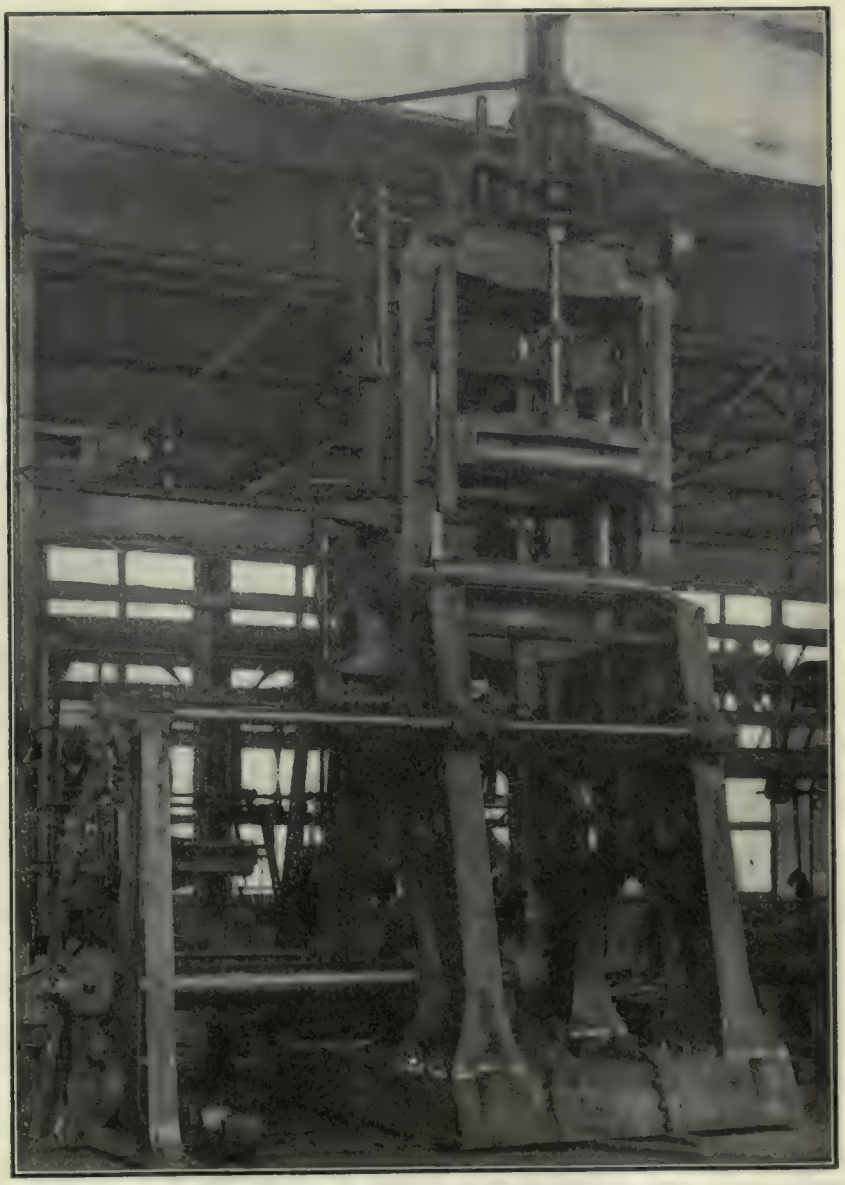
Any designer of heavy mill machinery will recognize that some of the above conditions were radical. First, the usual practice in all heavy stock gangs is to place about 2 feet of oak timbers between top of concrete pier and bottom of machine to serve the purpose of a cushion to the extremely heavy stresses generated in the crank shaft by the heavy unbalanced loads running vertical at high speeds. The writer can recall instances where the best 10 and 12-inch steel shafts procurable failed after being but a few months in service; one of the largest firms on the Ottawa River, making it a practice to replace all stock gang crank shafts after 12 months' service, whether these showed defects or not.

It was finally decided to ask the John Inglis Co., of Toronto, to assist in developing a machine to meet our requirements, they agreeing to put a machine together to suit us, but not being held liable for faulty design or performance; the firm of McLachlin Brothers, Ltd., Arnprior, being alone responsible for the success or failure of the complete mechanism.

Figure 1 gives a somewhat clear idea of the new machine when finished and standing in the shops in Toronto. This new Stock Gang, running nearly to 100 tons in weight, is we believe the heaviest machine attempted up to present time, and some of the details of the design will probably be of interest.

**Details of Design.**

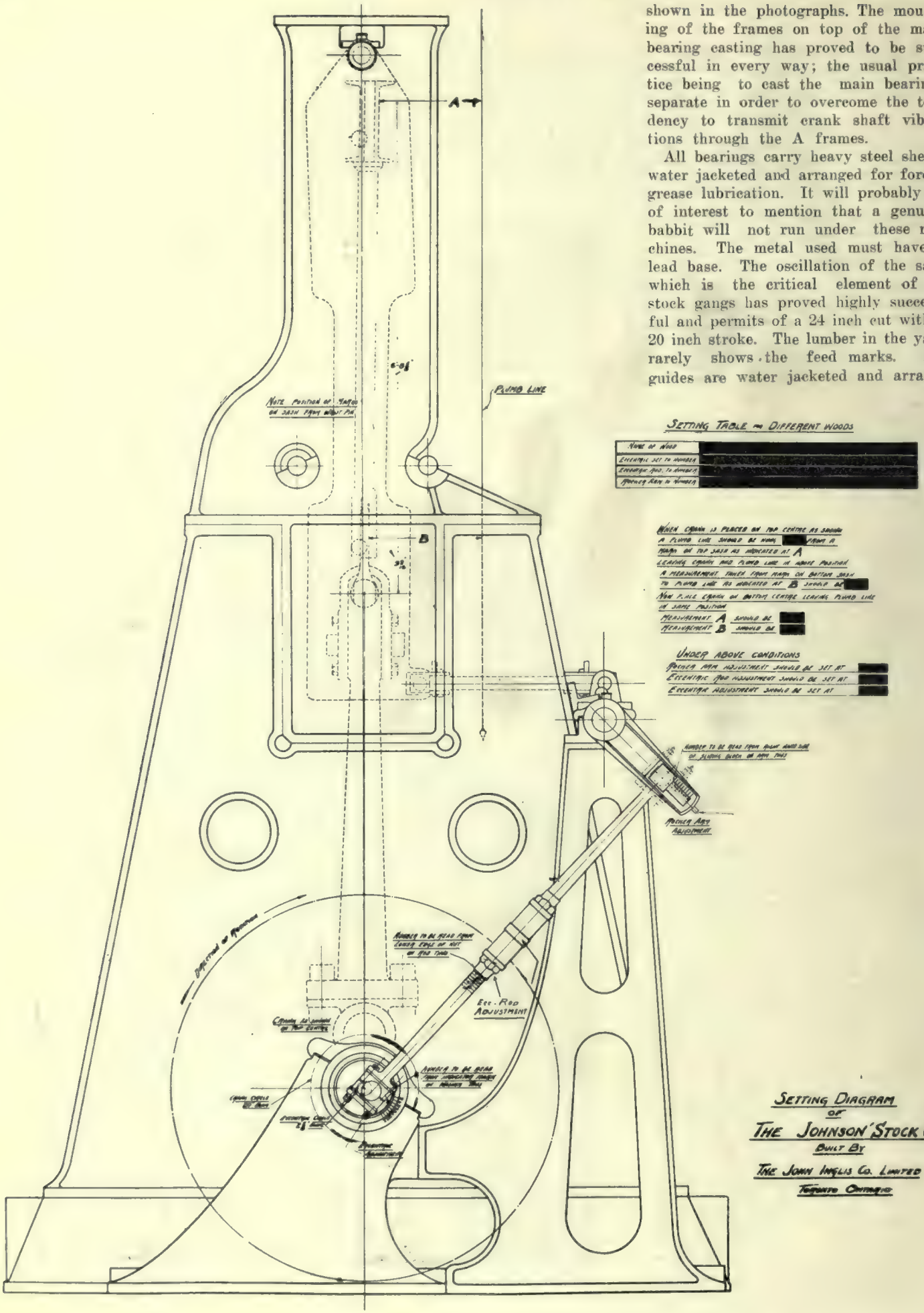
The illustration shows crank shaft stripped. When ready for work, this shaft carries a heavy 48 inch dia. by 48 inch face pulley with double web construction instead of the usual arms, also two 3-ton fly wheels about 6 ft. dia., one of the latter being mounted on crank disc. Having been proved on other machines of this type that an 8 inch crank pin shrunk into a steel disc would only stay tight a few months, it was decided to machine pin and disc out of the solid—this is quite clearly



The Johnson Stock Gang in the Erecting Shop of the John Inglis Co., Toronto.

shown in the photographs. The mounting of the frames on top of the main bearing casting has proved to be successful in every way; the usual practice being to cast the main bearings separate in order to overcome the tendency to transmit crank shaft vibrations through the A frames.

All bearings carry heavy steel shells, water jacketed and arranged for forced grease lubrication. It will probably be of interest to mention that a genuine babbit will not run under these machines. The metal used must have a lead base. The oscillation of the sash which is the critical element of all stock gangs has proved highly successful and permits of a 24 inch cut with a 20 inch stroke. The lumber in the yard rarely shows the feed marks. All guides are water jacketed and arrang-




SETTING DIAGRAM OF THE JOHNSON STOCK GANG BUILT BY THE JOHN INGLIS CO. LIMITED TORONTO ONTARIO

ed for forced-feed oil lubricant. Metal of any kind will not run on these guides, but an arrangement of end lignum vitae with brass centre will run indefinitely with very little wear. The crank pins are water jacketed and arranged for forced-feed grease as shown in Fig. 3.

The oil is fed to the centre hole, a packing nut being provided. The two outer tubes are for the water supply, inward and outward flow. In the illustration, 1 is a brass crank arm; 2, a brass collar; 3, a brass sleeve; 4, a brass nut; 5, a brass nut; 6, a brass ring; 7, wrought iron set screw; 8, wrought iron oil pipes and 9, tap bolts. Steel castings and forgings are used freely throughout the design; the sash and lower girt being of special selected material. Screw press rolls were

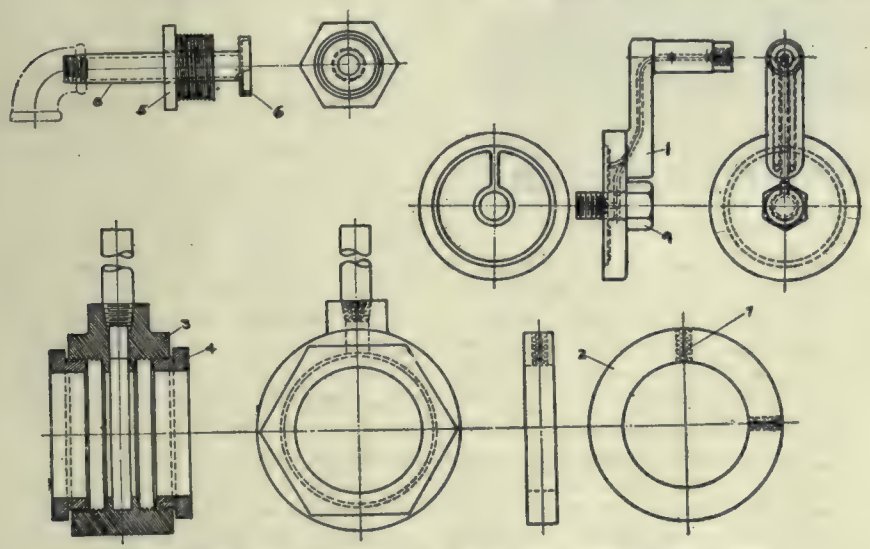


Fig. 3.—Crank Pin Lubricating Device on Johnson Gang Press.

used on the machine shown, but steam binders were fitted to two other gangs developed at the same time, and designed to handle the small stocks.

It will probably interest vertical engine designers and engineers, who are accustomed to gently easing a crank pin over the centre by nicely adjusted lead and cylinder compression, to state that these machines with a heavy crank pin load of some tons running at 260 rev. per minute, can be made to run as cool and smoothly as a quiet running engine. The performance of the machine illustrated and the two small machines not shown has been peculiarly consistent and successful in every way. After a season's run with an output of approx. 70 million feet of pine, the stoppage clerk's reports fail to show a stop of any of the above mentioned machines of longer duration than 20 minutes during a 10 hour working day. This we believe is a record, and may disprove the idea usually held that a large saw mill is somewhat loosely run, instead of the highly specialized business it has become of late years.

In conclusion I would like to record my appreciation of the genial co-operation of the The John Inglis Co. especially Mr. Printz and Mr. Ward of the draughting office, to whom much of the success of the machines described is due.

## RAILWAY AND CANAL EXPENDITURE IN CANADA.

The annual report of the Department of Railways and Canals shows a total expenditure by the department during the year of no less than $40,180,326, of which $36,301,979 was on railways. The main items of capital expenditure included $23,488,208 on the National Transcontinental, $184,149 on the Hudson Bay Railway, and $227,563 for the Quebec bridge. It is interesting to note that the total Government expenditure on railways in Canada now amounts to the enormous total of $475,489,401, while on canals the total expenditure has been $130,200,470, making a grand total expenditure of $606,000,000. On the other side of the account there has been a total revenue from Government railways of $157,406,587, and from the canals of $14,377,392. On the National Transcontinental Railway the capital expenditure last year was $55,293,999. During the fiscal year the total payments of the railway subsidies were $1,284,892.

The main figures with regard to the operation of government railways last year show gross earnings of $10,249,394, with a net profit of $211,515. The Intercolonial Railway working expenses were $9,595,976, with earnings of $9,863,783, a profit of $267,806. It is pointed out, however, that an additional amount of $200,000 was taken out of revenue at the end of the year and placed to the credit of the fund for renewals. If this extra amount for renewals had not been so taken the net profit for the year would have been nearly half a million. The deficit on the Prince Edward Island Railway was $86,684, and on the Windsor branch $30,693.

The total traffic through the canals in 1910-11 was 42,990,608 tons of freight and 320,574 passengers, an increase in each case. On the Welland Canal 2,326,290 tons of freight were moved, of which Canadian vessels carried two-thirds, and the quantity of grain carried through the Welland and St. Lawrence canals was 485,499 tons, an increase of 40,080 tons over the previous year. On the Sault Ste. Marie Canal 36,395,687 tons of freight were moved, and the passage of 7,972 vessels was recorded. Of wheat, 68,396,300 bushels were transported.

## THE CANADIAN TUBE & IRON CO.

The demand for rivets, bolts, and nuts has increased steadily during the last three years, but during that period no new companies entered the field to meet it, until recently, when the Canadian Tube and Iron Co. was formed. With the advent of the new year, the bolt factory started producing, and from it there is now being amassed a stock of various lines. The head office and works are in Montreal on the Lachine canal. This latter water-way gives excellent shipping facilities, the coal, raw material, and finished product being handled by an electric crane, one runway serving both the barges and siding which connects with all the railways.

The bolt and nut plant of the new company comprises four buildings, a wire mill, forge shop, threading floor, and a warehouse; the four buildings covering an area of 60,000 sq. feet and having producing capacity equal to the largest mills in Canada. The machinery installed is all of the latest and most approved type, having been imported from various U.S. manufacturers within the last four months. The lines made include rivets, bolts, nuts and coach screws. For heavy nuts and bolts there is the usual equipment of crude oil furnaces and stamping machines. The smaller lines are punched cold. There is also a pipe mill producing butt-weld pipe of all sizes up to and including 4 inches. For galvanizing, the hot process is used, there being the usual tanks for surphuric and hydrocholoric acids and spelter.

The executive of the Canadian Tube & Iron Company is as follows:—

Pres.—J. W. McConnell.

Vice-pres. and man. dir.—J. L. Waldie.

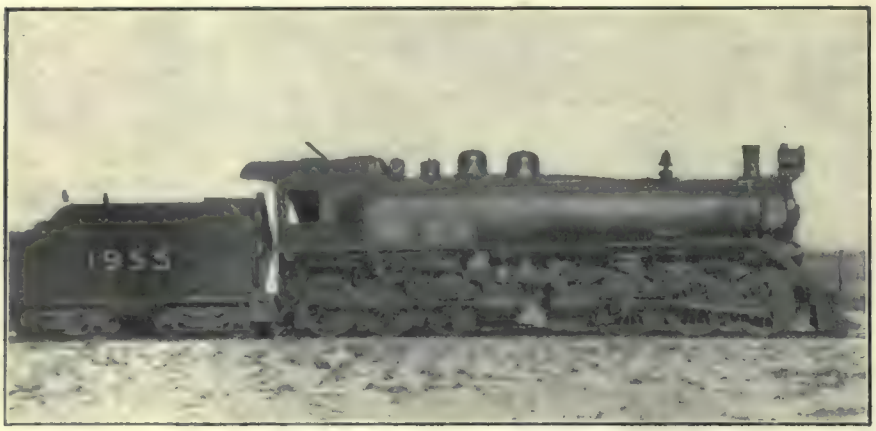
Sec.-treas.—H Worrall.

Sales man. and dir.—A. H. Hough.

Directors.—W Mosley, W. Molson McPherson, H. A. Lovett, Dr. Hersey.

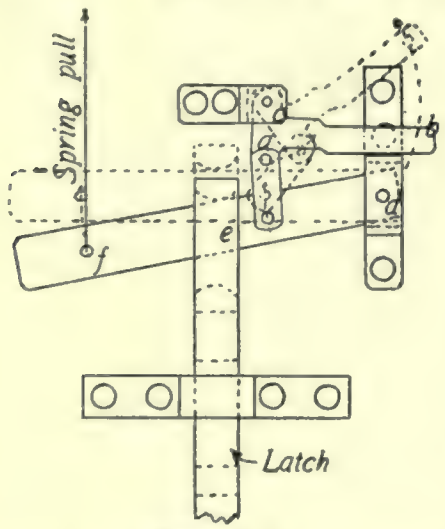
## THE LATEST MALLET LOCOMOTIVE ON THE C. P. R.

OUR illustration shows Engine 1955, the latest Mallet articulated locomotive turned out from the Angus Shops, Montreal. As announced in our issue of last October, it differs from previous Mallet engines built by the C. P. R. in being a non-compound and is the only engine of her class in America, if we except a much larger one built last fall by the Pennsylvania Railroad. The latter, however, has an entirely different wheel arrangement, being of the 2-8-8-2 type.




Non-compound Mallet Locomotive, C. P. R.

The four cylinders of Engine 1955 are 20 inches diameter by 26 inches stroke, each taking steam direct from the boiler. Distribution is by piston valves operated by Walschaert valve gear. Power reverse gear is provided and may be operated by either steam or air, the latter being the medium ordinarily employed. As may be seen from the illustration, the locomotive is of the 0-6-6-0 type, and has the cylinders back to back, this arrangement having been adopted on all the Mallet engines so far built by the Canadian Pacific Railway Co. The wheels are 58 inches diameter and the boiler pressure 200 pounds per square inch, which gives a tractive force at the rails of approximately 56,000 pounds. The total wheel base is 35 feet 2 inches, and the weight of the engine in working order is 262,000 pounds, all of which is of course available for adhesion. The tender is the same as that used with the M4 class of Consolidation engines, and has a capacity of 12 tons of coal and 5,000 Imperial gallons of water; its loaded weight being 133,000 pounds.




SKETCH B.

Portion of Steamshovel Dipper Door Showing Arrangement of Spring Latch.
(a) Toggle Joint. (b) Power to break Joint. (c) Fulcrum of toggle lever. (d) Fulcrum of spring lever. (e) Weight of latch. (f) Power of spring.

### Boiler Particulars.

To provide steam to four high pressure cylinders, the boiler of No. 1955 is of course larger than those on sister engines, which are compound. It is fitted with standard Vaughan-Horsey superheater and has the following general dimensions:—

| | Inches. |
|---|---|
| Outside dia (front course)..... | 65¼ |
| Outside dia (behind taper course) | 74½ |
| Distance between tube sheets 20 ft. | 0⅜ |
| Number of tubes: | |
| 24—5¼ inches dia. | |
| 167—2¼ inches dia. | |
| 18—2 inches dia. | |
| Total.. | 209 |

| | | Sq. Feet. |
|---|---|---|
| Heating Surface..... | Tubes | 2,764 |
| | Firebox | 185 |
| | Superheater | 548 |
| | Total.. | 3,497 |
| Grate Area ..... ..... | | 59 |

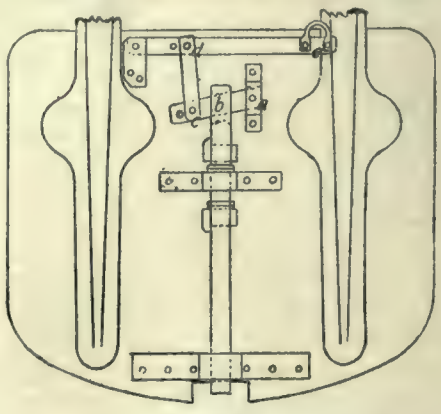
The board seen on the side of the smoke box, near the front, carries a water gauge for measuring the vacuum caused by the blast. This gauge is not a permanent fixture, being placed there for experimental purposes only. At the time of writing, the engine is undergoing a series of tests between North Bay and Chalk River, upon satisfactory completion of which, she will be put into freight or pusher service on the British Clumbia division.

## STEAMSHOVEL DIPPER TRIPS.

AN investigation is under way at the Panama Canal to determine the relative efficiency of the steamshovel "trips," operated by steam, known as the Geddes and Wichman "trips." These are a culmination of a development in the improvement of tripping devices that began soon after the first steamshovels were set at work in Culebra Cut.

**Suitable Unlatching Device the Aim.**

In the accompanying sketch C, the dipper of the shovel is shown in dumping position, the emptying process being accomplished by pulling a latch, by which the door of the shovel is held. When the shovel is ready to dig, the dipper is near the ground with its centre back of a vertical line through the centre of the shipper shaft, as the shaft of the big gear is called. In this position, the door of the dipper closes of its own weight and is latched firmly. When the dipper is loaded, the spoil within it bears down upon the door and tends to hold it so firmly in place that the power required to open the latch is often so great as to cause a serious strain on the craneman, who unlatches the door. Ease in opening the door is an advantage, both to the craneman and in accelerating the work of digging. The various improvements on methods of unlatching, or of "tripping" the latch, as it is called, have in view this dual advantage.




SKETCH A.

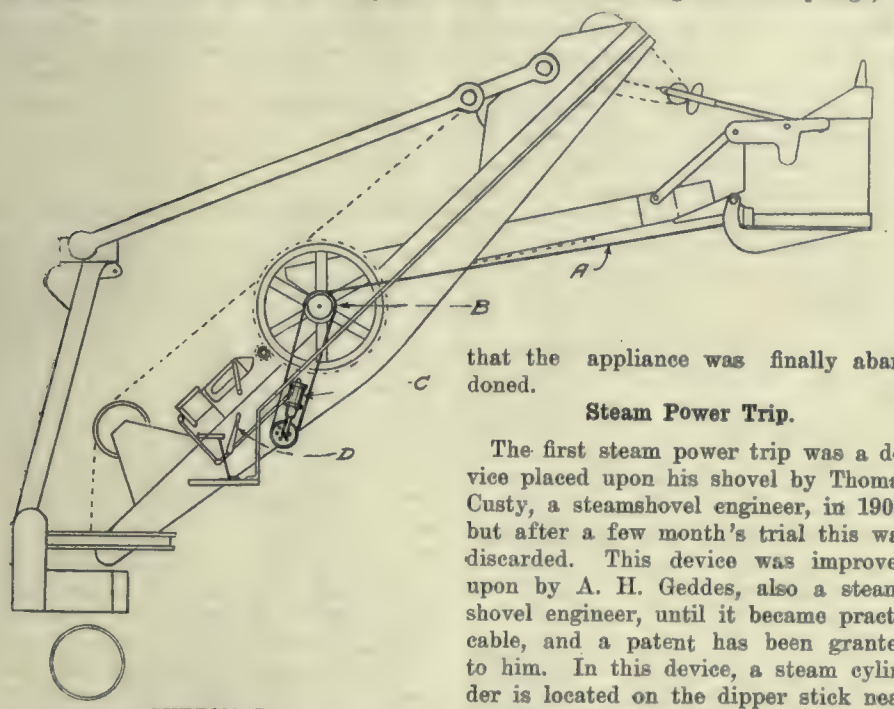
Door of Dipper of 95 ton Steam Shovel Showing Compound Latch Trip.
Height of Door ..... 4¾ feet
Width ..... 5½ feet

When the shovels arrived on the Isthmus they were equipped with a single lever latch operated by a 1¼-inch rope in the hand of the craneman, and attached at its other end to the

"trip" of the dipper. Several pulls were often necessary to open the latch, and almost invariably a great effort was required. The string by which this "trip" was operated passed through a sheave on the dipper stick near the dipper and thence to the craneman's hand.

**Unlatching Improvements Devised.**

The first improvement was to compound this original "trip," and in the drawing herewith A, the compound




SKETCH C.
Steamshovel Boom, showing Dipper Stick, Dipper, and Operating Gear, with Wichman Tripping Device.
A—½-inch Wire Rope. B—Winding Drum. C—Steam Cylinders. D.—Operating Lever.

"trip" is shown. The original was the simple lever with the fulcrum at (a), the weight at (b) and the power at (c). In the compound "trip," another fulcrum was made at (d) and the power was applied at (e), where the line was attached. By this device a movement of 20 inches in the line resulted in a 1-inch movement of the latch.

Among improvements upon the compound device, one that was given a trial in 1909 was the "spring trip" which consisted of the lever, shown in the second illustration herewith, B, and a bar passing through a slot in the latch, with a spring attached at its outer end; the power for unlatching being supplied by the spring. The rope by which the "trip" is operated is attached at (b), the fulcrums are at (c) and (d), at (a) is a toggle joint, at (e) the weight and at (f) the power applied by the spring. The door is closed by its own weight, when in digging position, placing a tension of 1,300 pounds upon the spring, and drawing the toggle joint erect. When the dipper is in the dumping position, the craneman pulls the rope, thereby breaking the toggle joint and allowing the spring to exert its pull upon the latch, which flies back, permitting the dipper to empty. The spring required was of ½-inch wire, 31 coils, 2¼ inches outside diameter, and 21 inches long when free. This device worked satisfactorily, but the toggle joint required constant renewing, and some difficulty was experienced in obtaining suitable springs, so that the appliance was finally abandoned.

**Steam Power Trip.**

The first steam power trip was a device placed upon his shovel by Thomas Custy, a steamshovel engineer, in 1908, but after a few month's trial this was discarded. This device was improved upon by A. H. Geddes, also a steamshovel engineer, until it became practicable, and a patent has been granted to him. In this device, a steam cylinder is located on the dipper stick near the dipper, the piston is connected with the dipper latch through a chain and a series of levers, and when steam is admitted to the cylinder, the thrust of the piston operates the levers and unlatches the door. Steam is admitted and exhausted from the cylinder through a three-way valve located on the boom beside the craneman's seat. A steam pipe extends from the valve along the boom opposite the dipper stick slot, and at the end of this pipe and on the cylinder, are universal joints which are connected with one another by a flexible hose. After a thorough trial this device was adopted, upon the recommendation of a committee of two mechanical experts and a steamshovel engineer, who reported that the capacity of a shovel was increased 100 cubic yards a day by its use.

**A Further Improvement.**

The latest device, that shown in the illustration, was invented by F. S. Wichman of the Mechanical Division. The latch is opened by a pull made on a ½-inch wire rope by the outward thrust of the piston of an air brake cylinder. The mechanism is fixed upon the boom of the shovel. A drum is mounted upon the face of the thrusting gear, or shipper shaft, which revolves with the shaft, thus winding or unwinding the tripper rope, according as the dipper shaft moves up or down. In this way the rope is kept taut at all times. To give the lengthwise pull of the cable, a 6-inch diameter steam cylinder is mounted below the drum. This cylinder has a push piston, the outer end of which is bifurcated to receive a sheave, over which the cable passes on its way to the drum. Steam is admitted to the cylinder, when it is desired to trip the dipper door, through a three-way cock, operated by a lever at the craneman's seat. When the steam exhausts, the spring in the cylinder pulls the piston back into position, and the tripping operation may then be repeated. This device has undergone a successful test on two 95-ton steamshovels.—Canal Record.

## FINANCES OF THE DOMINION OF CANADA.

The statement, indicating the condition of the finances of the Dominion of Canada at the end of December last, which has just been issued by the Finance Department, shows that during that month the public debt decreased $2,049,980, as compared with $878,661 during the same month of 1910. The net debt amounted on December 31 to $313,386,651, as against $315,436,632 on November 30, and $326,885,959 on December 31, 1910. The gross debt at the close of the year was $478,488,871, as compared with $477,587,701 a year before.

The statement announced that the revenues of December totalled $11,596,099, and the revenues for the nine months ending December 31 totalled $99,482,947. The figures for December, 1910, and for the first nine months of that year were $9,790,387 and $85,665,833, respectively. Expenditures on consolidated fund were in December last $6,519,861, and during the nine months' period $54,303,871. The figures in 1910 were for December $5,355,286, and for the nine months $52,994,133. Capital expenditures amounted in December, 1911, to $3,148,159, and in the nine months ending December 31 to $18,983,354. The capital expenditures in December, 1910, totalled $3,680,305, and in the nine months ending December 31 of that year $22,804,247.

## LARGE LOCOMOTIVE CONTRACT.

The Montreal Locomotive Works, Ltd., have recently received from the Canadian Pacific Ry., an order for 75 ten-wheel engines of the D.10 class, having cylinders 21 inches diameter by

28 inches stroke and 63-inch wheels. The boiler has a total heating surface of 2,420 square feet, and is fitted with the Vaughan-Horsey superheater. The steam pipes from superheater to cylinders will be located outside the smoke-box, in accordance with the most recent practice on the C.P.R. The engines weigh about 190,000 pounds in working order, exclusive of the tender. Delivery is to commence in May and be completed in August.

This substantial contract will doubtless give employment to a full staff at the Montreal Locomotive Works.

## THE DOMINION BRIDGE CO.

The Dominion Bridge Company is going to locate a large western plant at Calgary. This has been decided by the board of directors. The Calgary plant will be bigger than that at Winnipeg. The western business has grown to such an extent as to make a plant in the west a necessity.

The board of directors had almost decided to triple the size of the Winnipeg shops, which at present employ between 300 and 400 men, but on considering the matter further, they arranged to look Calgary over, as the greater bulk of their western business lay beyond Winnipeg. A short time ago, J. K. L. Ross, a director and son of James Ross, the chief shareholder of the company, went to Calgary, and having studied the location and conditions, thought it would be more profitable to build a plant there, and reported to the board of directors accordingly.

## INDUSTRIAL EDUCATION IN LONDON, ONT.

By Thames.

FEW movements have been so characteristic of the economic and social conditions of the age in which they occurred as the Industrial Education movement. It has been a direct result of changed modern industrial conditions. The specialization in the large industries of to-day has resulted in reducing the workman in many cases, to a mere operative with little or no knowledge of the processes which precede and follow the one which he, day in and day out, performs. The apprenticeship system has well nigh passed away; it is, therefore, little to be wondered at that thoughtful men the world over are agreed that some means must be devised to supply to the rising generation of workers the training which modern conditions require of the successful artizan, but which no longer can be obtained in the shops.

Germany was the first country to attack the problem, and it is still from that country that much of the inspiration and guidance along industrial education lines may be drawn. England, France and Switzerland followed in her wake, and now the movement has spread to America. Canada naturally did not feel the pressure of the charge so soon as the older countries where competition was more keen, but the problem of industrial education is now a question of national movement with us.

The city of London, Ont., happens to be a leader in this advanced educational movement. Mr. E. R. Dennis, the head of one of the large iron industries there has long been an advocate of the cause. He established classes for his own employes to demonstrate what might be done along this line, and was a candidate for the school board, making industrial education the issue. So impressed were the electors, that Mr. Dennis was given the largest vote ever polled in a school trustee election in that city. The Board have now established a general evening industrial school which has no equal in Canada, and were fortunate in securing in Mr. H. B. Beal as principal, a gentleman who was thoroughly posted on the industrial education movement in other countries, and in addition possessing exceptional executive ability, was well acquainted with the local requirements.

What impresses one most in discussing the question with Mr. Beal is the definiteness of the aim which he has in view and the clearness with which he states it. He knows just what the school aims to do, and is quite as free to tell you what it does not attempt to accomplish. One of the factors which has sown doubt as to the success of the movement generally, in some quarters, is the lack of definiteness of aim of its advocates. This is certainly not the case in London. The London industrial school has three main courses for men and boys, viz.:—Machine Shop Practice, Woodworking and Forge Shop Work. Each student selecting one of these courses must take with it a course in drawing and must also devote a short period to English. This feature, of insuring that each student who takes a shop course will also gain an acquaintance with the making and use of mechanical drawings and blue prints and will possess a sufficient knowledge of English to express himself intelligently, is one of the unique features of the London school.

The women and girls receive instructions in dress-making, sewing, cooking and home economics from instructors who fill the responsible positions in city establishments at their respective lines of work. The women and girls also take a course in practical English.

That London has approached this practical problem in a thoroughly practical manner may be judged from the fact that the instructors in every department are those who have been a success in the same line of work in local industries. She is not following the mistake that so many other places have made in attempting to give an academic solution to an intensely practical problem. Any of our readers, who may be passing through, will do well to take an evening off and visit the London Industrial School. They will find a first class equipment, an energetic and enthusiastic lot of teachers and a class of pupils who tax the classes to their utmost capacity.

## UNSAFE RAILS ON U. S. RAILWAYS

James A. Farrell, president of the United States Steel Corporation, in his evidence before the Stanley Steel Investigating Committee, threw much light on various phases of the steel business. He testified that most of the rails used by the great railroads of America, are of an inferior grade; that the lines placed economy before safety, and that such rails would not be tolerated in Great Britain.

As to the use of inferior rails, Mr. Farrell said that virtually all the American systems demand rails containing a large proportion of carbon, because they are more economical than soft steel rails. He told the committee that while rails with a high proportion of carbon, gave in many instances long and excellent service, they were liable to become brittle, crack and cause wrecks. Reports made by the chief inspector of safety appliances of the Interstate Commerce Commission, he continued, state that many wrecks were caused by rails cracking or separating, which conditions were superinduced by "pipes" in the steel. These "pipes" were caused by too much carbon in the steel.

The rails used, according to his testimony, are cheaper than those used in any of the great European countries, notwithstanding the fact that they are forced to bear greater loads, under more trying conditions, than are imposed upon the rails of Europe.

A locomotive of 1,000 h.p. driven by a Diesel engine, has just been set to work on the Prussian State Railways. The drive is direct to the axles, and the outward appearance is similar to that of an electric locomotive. Nearly $60,000 have been spent in experimenting with this engine.

# Oil Burning Locomotives on the Tehuantepec N.R.R. Mexico*

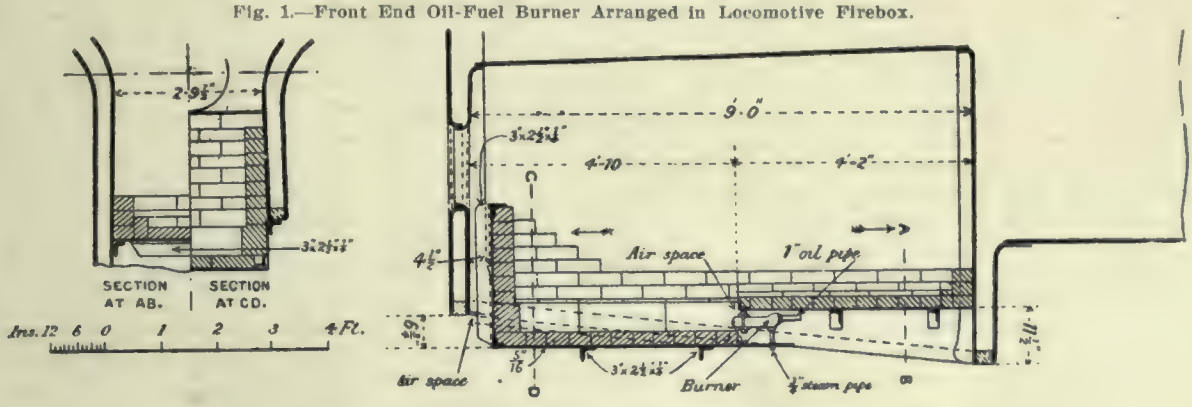
By R. Godfrey Aston**

*The Question of Oil Fuel for Steam Boilers is a Particularly Live One at the Present Time, and in View of the Fact That Our Great Railroads Have Under Consideration the Adoption of Oil Fuel in Their Locomotives, the Information and Data Furnished by the Writer of this Paper Becomes Particularly Opportune and Valuable to the Many Readers of this Journal in Railroad Shops, etc.*

THE object of this paper is to give an account of liquid-fuel burning in the locomotives of the Tehuantepec National Railway, showing some of its advantages over coal, and giving a general description of facilities for handling and storing this fuel-oil, the methods of burning it, and a few results gained which are taken from the monthly performance of locomotives. The author does not intend to deal fully with costs, etc., as it is too large a subject for so short a paper, but will confine himself to a more practical point of view.

Tehuantepec National Railway.

Fig. 1.—Front End Oil-Fuel Burner Arranged in Locomotive Firebox.



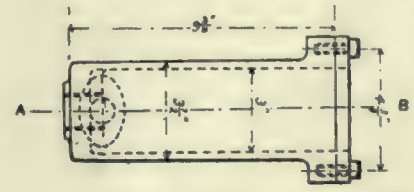
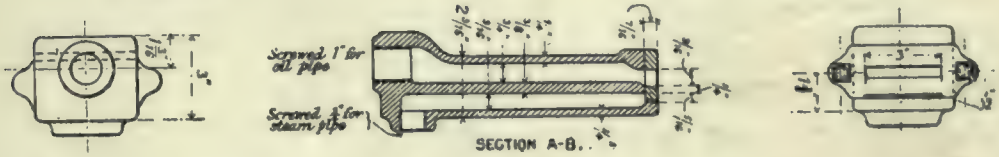




FIG. 2.
*Locomotive Oil-Burner or Atomizer.*

Made by the Company.




The Tehuantepec Railway is a transcontinental line of standard gauge, 4 feet 8½ inches, 189 miles long, running across the Mexican Isthmus of Tehuantepec from the port of Puerto, Mexico (Coatzacoalcos) on the Atlantic, to the port of Salina Cruz on the Pacific, with grades varying from level to 2.15 per cent., and abounding in curves up to 11 degs. 28 mins. radius, and where the speed of trains is limited to 15 miles per hour.

### Storage Facilities.

All fuel-oil for the company is received at the terminal of Puerto Mexico, where the main storage-tanks are situated; these comprise three cylindrical steel tanks, each composed of six tiers of steel plates riveted together and a light steel roof, with three manholes, and a ventilator in the middle through which gases arising from the oil can escape. Two of these tanks are 95 feet diameter and also used for giving oil to engines, etc. 37 feet 6 inches deep, each with a capacity of 46,996 barrels of 42 United States gallons (35 British gallons). The third tank is 92 feet diameter and 29 feet 9 inches deep and has a capacity of 35,138 U.S. barrels.

These tanks are all enclosed in separate earthen embankments, and are connected together by an 8-inch pipe-line, which enters the tanks 18 inches from the bottom; this space being required for water, settling out of the oil, etc., and which can be drawn off through a 3-inch valve at the bottom of the tank. The pipe-line runs down to the wharf, where it is fitted with an 8-inch check-valve, and it is from here that vessels delivering cargoes of oil can pump straight into any tank, the two largest tanks being about 1¼ miles from the wharf. At convenient places in the pipe-line, near to the round-house, are stand-columns for filling engine-tanks, tank-cars, etc., and near the round-house is also a supply tank of 28,000 U. S. gallons capacity, erected upon a structural steel frame,

The terminal of Salina Cruz is laid out in the same manner, except that there are only two storage-tanks, 95 feet diameter and 37 feet 6 inches deep, of 46,996 barrels capacity. The capacity of all these storage-tanks has been calculated out in U.S. barrels of 42 gallons for every 6 inches of depth, allowance being made for all internal stays, supports, etc. The fuel-oil is shipped from Puerto Mexico to the other fuel-stations in specially constructed double-truck steel-frame tank-cars of 6,600 U.S. gal-

*Paper read before the Institution of Mechanical Engineers, London, England, December, 1911.

**Graduate Institution of Mechanical Engineers, Rincon Antonio, Oax., Mexico.

lons capacity, the gallons per inch of depth of these cars being known, so that the exact amount contained in each car can be credited to the station to which it is shipped.

**Fuel Oil.**

The fuel-oil used is purchased from the Texas Company of Port Arthur, Texas, at about 97½ cents gold, per barrel of 42 U.S. gallons delivered at Puerto Mexico, and pumped into the Railway Company's tanks by the delivering vessel. This fuel-oil is generally delivered in tank-steamers, and sometimes towing barges, which come right up alongside the Railway Company's wharf. The coupling between the vessel and the company's land pipe-line is made with a flexible rubber or steel hose, which is supplied by the vessel.

This fuel-oil is quite thin, and flows readily through pipes of any diameter; it is sometimes nearly black in color, and sometimes a dark brown with a green fluorescence. The Railway Company stipulates in its contracts with the Texas Company that the flash-point (closed) shall not be under 110° F., as a lower flash-point than this is liable to be dangerous on account of the volatile gases and fumes which arise from the oil at comparatively low temperatures. The author has seen the oil catch fire from a torch which was some 10 or 12 feet away from it. Some oils may be used in the crude state as fuel, while others have to be passed through the refinery. After the lighter oils, etc., have been taken off, the by-product or residuum is used in a satisfactory manner as fuel, and as such has been and is used in Mexico. Fuel-oil contains no power of spontaneous combustion, and unlike coal does not deteriorate if stored in tanks or reservoirs.

The specific gravity of this oil varies from 0.790 to about 0.942, and its weight per U.S. gallon from 6.4 to 7.75 lb. The British Thermal Units vary from 17,000 to 20,000, the average being from 19,500 to 19,800, and between this and the best steam-coal there is a very great difference. The analysis of two samples of the oil as used by this company for fuel is as follows:—

| | | |
|---|---|---|
| Specific Gravity @ 60° F. | 0.931 | 0.881 |
| Baume Gravity @ 60° F. | 20.5° | 29° |
| Flash-Point (closed) | 130° F. | 135° F. |
| Flash-Point (open) | 160° F. | 160° F. |
| Fire Test | 220° F. | 224° F. |
| Setting Point | 3° F. | 20° F. |
| Viscosity @ 100° F. | 200 seconds (Redwood) | 78 seconds (Redwood) |
| Sulphur | 0.77 per cent. | 0.26 per cent. |
| Calorific Value | 10,688 calories | 11,000 calories |
| Color | Dark brown | Dark brown |
| Water and Dirt | 1 per cent. | 0.25 per cent. |

The standard temperature for the measurement of fuel-oil is 60° F., and expansion is allowed for at the rate of 1 per cent. for every 20° F. increase in temperature above 60° F., and contraction at the same rate for decrease in temperature below 60° F.

**Locomotives.**

The locomotives in use on this road are of the Baldwin consolidation type, the main dimensions of which are:

Cylinders—20 inches by 26 inches.

Wheels (drivers)—53 inches diameter on tread.

Fire-box—Length inside, 108 inches; width inside, 33½ inches.

Flues—239 of 2 inches outside diameter.

Grate area—24.94 square feet.

Heating surface—Fire-box, 147; flues, 1,700. Total, 1,847 square feet.

Boiler pressure—170 lbs. per square inch.

The oil-tank is fitted into the coal space of the tender, and its contents calculated for every half-inch of depth. Most oil-tanks have a capacity of 2,000 gallons, and the oil is fed from the tank to the burner or atomizer through suitable connections and flexible brass ball-joints.

**Fire Box Arrangement.**

The company's practice, after trying various types of burners and atomizers, is to use what is called a front-end burner, Fig. 1, that is, the burner mouth points towards the back of the fire-box, or fire-box door-plate. The burner is placed in a 9-foot fire-box, 4 feet 2 inches from the flue-sheet, the flame playing against a brick wall built up to the level of the fire-box door opening. Between this brick wall and the fire-box back-plate is a 4-inch air-space extending the whole width of the fire-box and right up to the top of the brick wall. Brick walls are built up on each side of the fire-box from the height of the brick wall at the back, gradually sloping downwards; the floor of the grate or ash-pan is laid all over with fire-brick. No brick arch or baffle plate is used.

As mentioned in the preceding paragraph, the burner is placed 4 feet 2 inches from the flue sheet, and midway between the sides of the fire-box, so that both in front and behind the burner or atomizer there is a flat bricked-over area of fire-grate: and as the burner is placed parallel to the lower grate, there is a 4-inch space between the front and back grates, this 4-inch space being left open to admit air, extending from one side of the fire-box to the other.

**Brickwork.**

This should be of the very best material and workmanship, as it is subject to a much greater heat than from a coal fire; if this is not done, the walls will not stand, and engine failures will occur; moreover, the failure of only one brick will perhaps necessitate new brickwork throughout, thus needlessly running up expenses. There is no reason why the brickwork should not stand from four to six months, and perhaps longer, if due care be taken from the start. A good brick should contain about 80 to 85 per cent. of silica and from 20 to 15 per cent. of alumina, and should be as free as possible from alkalies, which cause fluxing. A good brick becomes surface-glazed though remaining rough and porous. It should be perfectly dry when built up in a fire-box, otherwise the heat will cause it to crack. If possible, the fire-bricks should be fired at a temperature as high as that to which they will be exposed when in use.

**Burner or Atomizer**

There are many and various kinds of hydro-carbon burners, and after a trial of various types, including the "Baldwin" and "Best" burners, this company is using with considerable success a burner which is made in their own shops, and which is really an inverted "Best" burner, Fig. 2. It is a simple device which allows the oil to fall from an orifice 3 inches wide by 9-16-inch deep over the top of a flat steam-jet 3 inches wide and 1-32-inch deep, the steam picking up the oil and sending it into the fire-box in the form of a spray. The underneath jet of steam delivers the spray of oil at an angle, so that it strikes the brick wall in the middle, instead of shooting out from the burner parallel with the bottom of the ash-pan. This burner may be called an outside atomizer, and although it is in general use it has its drawbacks; but it has been found to be more efficient than any other they have used.

The most essential points about a burner or atomizer are:

(1) Its atomizing capacity. All fuel-oil is heavy, and will burn in the form of a vapor or spray only when mixed with air. The object should be to fill the fire-box with a soft and voluminous flame, and not to impinge it in any one place.

(2) Its facility for keeping clean and free from clogging.

(3) Its adjustability in giving the right direction to the flame or spray, and regulating the proper proportion of oil and the agent, either steam or air, used for atomizing.

A burner that will vaporize or atomize the oil at the point of expansion of the agent used for that purpose, which is easily handled, and will atomize the greatest amount of fuel with the least possible energy, is the highest and most efficient that can be designed. On this

railway, steam is used as the atomizing agent, because, after various experiments, it was found to be superior to air. The steam to a very great extent heats the oil as it flows into the burner before delivery in the form of a vapor spray. The flame from the burner should not be too long or it will pass into the flues and become extinguished. Gases which are only partly consumed will relight in the smoke-box.

**Lighting-up an Oil Burning Engine.**

In each round-house of this company is a stationary boiler, always in steam, used for the washout and other pumps, as well as for lighting up dead engines. From this boiler is laid a 2-inch steam line to points between each engine road or stall. From there a connection can be made to a locomotive through a 3-way cock, or T piece in the steam-pipe leading from the steam stand on top of the fire-box to the burner. By use of this steam the burner can be started and kept going until the boiler has generated enough steam to keep the burner going itself. A piece of oily waste is lighted and thrown into the fire-box just in front of the burner from which the spray ignites. Connections can be made to any other engine all ready in steam should the stationary boiler not be available for any reason.

**Firing and Cleaning Flues on the Road.**

With an oil-burning engine there is always a fire of equal intensity and one which never gets dirty, so that good steaming is practically ensured. It is a popular idea that it is a very easy matter to fire an oil-burning engine, but this is not the case, as both skill and care are required, so that the author thinks it best to lay down a few of the most important rules:

(1) See that the oil-tank is full, and if heaters are used, that they are in operation, and that the temperature of the oil is as it should be.

(2) See that the sand-box on the foot-plate is full, and that the scoop is in its place.

(3) Before starting the fire, see if the temperature of the fire-box is below igniting point, which is a dull red, and if so, open dampers (if used), start the blower, and open the atomizer-valve fairly hard; then put a piece of saturated oily waste on the bottom of the grate after setting it alight, close the dampers (if used) and fire-box door, and turn on the oil very light. When the oil has ignited, reduce the blower and atomizer to a light feed, also the oil until the chimney is quite clear of smoke.

(4) See that the fire is burning brightly, and that there is no oil on the bottom of the pan, also that the brickwork is in good condition, and that no bricks or any other obstructions are on the bottom of the grate or pan so as to obstruct the flame or jet on its way from the burner to the brick wall.

(5) As regards cleaning flues on the road, it is best to sand frequently if the engine is being worked hard, say every 9 or 12½ miles, but if the engine is being worked light, every 31 or 37 mile will be sufficient.

(6) Having attained a fair rate of speed, fill the scoop with about a quart of sand, close dampers (if used) and put reverse-lever near full stroke, then open regulator wide, insert the end of the scoop in the round hole in the fire-box door, and allow the sand to be drawn out of the scoop through the fire-box and flues and out of the chimney; sanding is best done when the engine is working hard up a grade.

(7) Black smoke shows incomplete combustion, and should never be allowed to be emitted from the chimney, as it only fills up the flues with carbon, which, besides being a non-conductor of heat, is also a great source of waste of fuel. If a bluish-colored smoke or fumes are seen coming from the chimney, it is a sign that the burner is cut down too fine.

(8) When putting out the fire, the oil-valve should always be closed first, then the atomizer-valve (in their case, steam), then the blower. The oil-valve is always the last to be turned on, and the first to be turned off.

(9) Never go near an open tank with a lighted lamp or torch, as at any time an explosion may occur, especially if the oil used has a low flash-point.

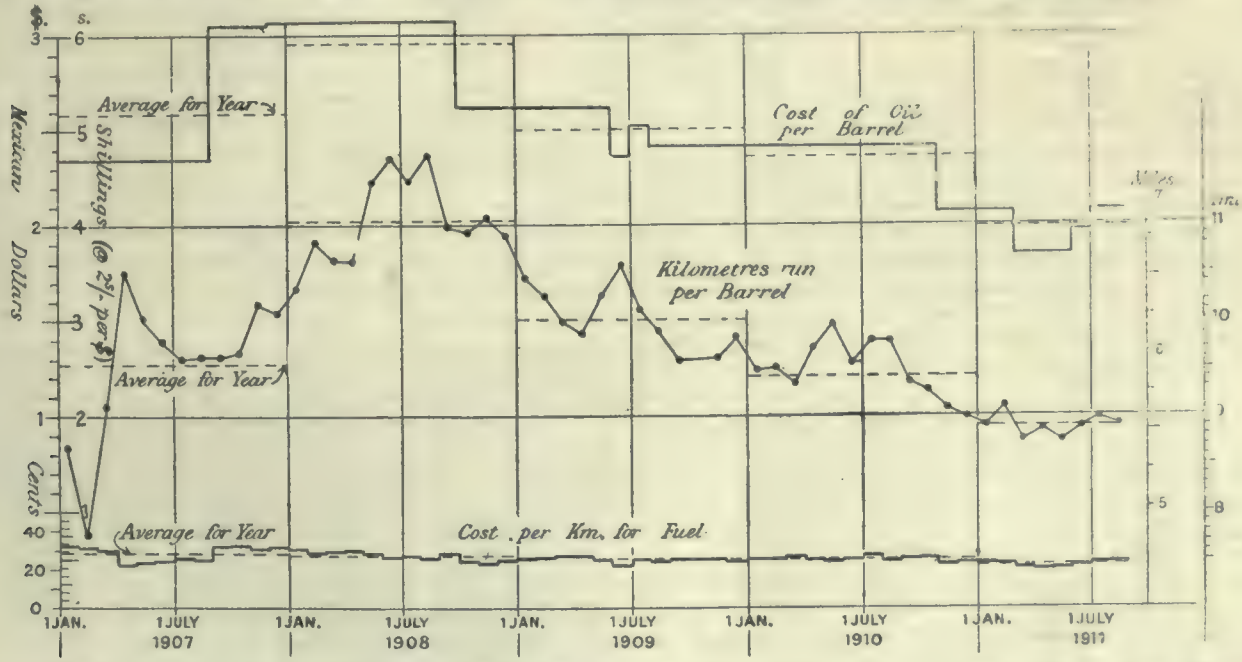



Fig. 3.—Diagram Showing Cost of Fuel-Oil, and Distance Run per Barrel, from January, 1907, to August, 1911, on The Tehuantepec National Railway.

**Round House or Shed Work.**

An oil-burning engine has a great many advantages over a coal-burner, but this is specially noticed in the round-house or shed when squaring up an engine after a day's run. There are no fires to be raked out, no flues or smoke-box to be cleaned (the smoke-box door of an oil-burning engine need be opened only once every three or four months for cleaning purposes); there is no coal to be sacked, weighed, or otherwise handled, and oil-burning engines do not carry fire-rakes, prickers, flue-brushes, shovels or picks, so that all these things, besides other minor details, represent a great saving in engine equipment.

Among other advantages are the rapidity with which steam can be raised and the facility with which the boiler

can be forced when greater calls are made. The author has in a special case of necessity raised steam in a dead engine to a pressure of 130 lbs. per square inch in 50 minutes from cold water, without any serious effects on the boiler, whereas in a coal-burner from 2 to 3½ hours is needed to raise steam if no jet from a live engine is used.

Another very great advantage is in switching, or shunting, or standing pilot, when engines frequently have to stand in steam for hours at a time. The burner can then be cut down or extinguished, thus effecting a great saving in fuel, as an engine will always retain a sufficient amount of steam to start the burner or atomizer again, and any danger of the fire-box or crown-sheet being injured through the water getting too low is entirely obviated. The heat lost while standing is the same whether coal-fired or oil-fired.

### Effects of Oil-burning on Fire-box, Flues, Etc.

Oil-burning is no more injurious to a fire-box or flues, etc., if ordinary care be used, than coal burning; in fact, from the author's experience it is not so hard on a fire-box as coal burning, for it is quite noticeable in the fire-boxes of coal-burning engines that stay-heads, plate edges, flue-ends, and crown bolt-heads show signs of wear, corrosion or burning, while in their oldest oil-burning engine not any of these signs are noticeable, everything being clean and in good condition.

This company uses steel boxes with wrought iron tubes and copper ferrules. A set of tubes will last and remain perfectly tight from 2½ to 3½ years, when they may have to be taken out to be re-ended. Some of the engines are working to-day with tubes over four years old, many of which are as tight as the day they were put in. Some of the wrought iron tubes are being replaced by mild steel, because, after the holes in the tube-sheet get worn, tubes of steel stand the expanding better; but at present those that are in service have not been in use long enough for one to form an opinion of them as compared with wrought iron.

### Oil Burning Locomotives in Mexico

Some people are of the opinion that more than 2 per cent. of sulphur in fuel-oil is injurious to the fire-box, but as the amount of sulphur in the Texas oil that the company has been using is below 0.75 per cent., no ill-effects have been noticed. As there are coals which show as high as 3.5 per cent., the author does not see why sulphur should be more injurious in oil than in coal.

### Engine Performance.

Although the engine tonnage has practically doubled since 1908, the author gives the following statistics, Fig. 3, for every month from January, 1907, to August, 1911:—

(1) Cost of fuel-oil per barrel of 42 gallons (Mexican currency);

(2) Cost per kilometre for fuel (Mexican currency); and

(3) Kilometres run per barrel of oil.

It must be understood that since about the middle of 1909, all engines are loaded down to their capacity, single trains averaging 750 to 800 tons behind the drawbar. As the road-bed is by no means level, helper engines are used over certain sections where the grades are long and heavy, so that this will explain the decrease in kilometres run per barrel of oil between 1908, 1909, 1910, 1911, as the tonnage per engine has been increased to the maximum.

**Oil-Fuel.—Montly Averages.**

| During | Cost of oil per bbl. Dollars (Mexican)* | Distance run per bbl. Miles. |
|---|---|---|
| 1907 | 2.585 | 5.928 |
| 1908 | 2.957 | 6.855 |
| 1909 | 2.502 | 6.209 |
| 1910 | 2.356 | 5.843 |
| 1911 (8 months) | 1.990 | 5.520 |

*The Mexican dollar is reckoned at 50 cents Canadian currency.

The cost of fuel-oil per barrel of 42 U.S. gallons as charged out every month is made up of the following items, and also depends upon whether there is any shortage or overage when the inventory is taken at midnight on the last day of each month; this accounts for the variation in prices:—

(1) Price of oil per barrel f.o.b. in ship's tanks at delivering port (Puerto Mexico).

(2) Commission to purchasing agents in United States.

(3) Consular invoices.

(4) Inspection fees for inspecting cargo in ships' tanks at shipping port.

(5) Stamps.

Items 2, 3, and 4 only refer to oil purchased out of Mexico.

Based on tests which have been made, the company reckons three-and-a-half barrels, or 147 U.S. gallons, of oil as being equal to one ton of coal of 1,000 kilograms, or 2,204 lb. or three-and-a-half barrels of oil equal one unit of fuel.

### Mexican Fuel Oil.

In August, 1911, the company received the first cargo of a native or Mexican fuel-oil under a contract with the "Campania Mexicana de Petroleo," El Aguila, S.A., at a price of $1.75 (Mexican) per barrel of 42 U.S. gallons delivered into railway company's tanks at Puerto-Mexico. This oil, which is used in its crude state as fuel, is jet black in color, thick, and has a heavy asphalt base, and although the company has not used it sufficiently long to be able to compare it with the Texas oil, it may be of interest to state a few of the difficulties met with when first they began to use it.

As this oil is thicker than Texas oil, heaters have to be used in the engine-tanks, but it has been found that if this oil is heated up to about 150° F. (which can be done with Texas oil), great difficulty is experienced in getting the burner spray to light, and that the oil settled very thickly at the bottom of the tank. It would not run through the pipes to the burner, and could only be burnt effectively by mixing a fresh supply of oil with it. In order to burn this Mexican native oil successfully, it requires to be only just warmed. When using this, a large piece of carbon or cokelike substance is formed in the fire-box, and grows up from the bottom of the pan or grate directly under the burner-mouth. This may vary from 6 by 4 by 4 inches to 12 by 10 by 8 inches in size, growing up in such a manner as almost to smother the burner-mouth. The analysis of this substance is as follows:—

| | |
|---|---|
| Ash | 1.25 per cent. |
| Sulphur | 7.89 " |
| Carbon | 90.86 " |
| Asphalt | nil |

It shows to a certain extent that there is incomplete combustion, which can be remedied by admitting more air; but this cannot very well be done without affecting the steaming qualities of the engines. However, by raising the burner slightly these lumps of carbon have decreased in size, and it is hoped eventually to adjust things in such a manner as to prevent their forming at all.

The analysis of two cargoes of this Mexican crude fuel-oil is as follows:—

| | No. 1. | No. 2. |
|---|---|---|
| Specific Gravity @ 60° F. | 0.944 | 0.942 |
| Baume Gravity @ 60° F. | 18.4° | 18.8° |
| Flash-Point (closed) | 78° F. | 102° F. |
| Flash-Point (open) | 104° F. | 120° F. |
| Fire Test | 165° F. | 180° F. |
| Viscosity @ 100° F. | 1,080 seconds (Redwood) | 920 seconds (Redwood) |
| Sulphur | 3.44 per cent. | 3.35 per cent. |
| Calorific Value | 10,971 calories | 10,610 calories |
| Color | Black | Black |
| Water | nil. | 0.5 per cent. |
| Asphalt | | 37 per cent. |
| Carbon (coke) | | 12 per cent. |

It may be explained that the 37 per cent. asphalt is obtained by distilling off the distillates from the crude until only 37 per cent. residue is left, which consist of asphalt.

The author regrets that at this time he is unable to go deeper into this subject.

# DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

## NEW GEOMETRIC DIE HEADS.

WE illustrate herewith the new style "D.D." self-opening and adjustable die-head which has recently been brought out by the Geometric Tool Co., New Haven, Conn. This die-head has been specially designed for use in the turret of the Cleveland Automatic Screw machines, but can also be employed on other automatic or semi-automatic machines in which the requirements of operation are substantially similar. It is made regularly in five different sizes, known as the 5-16, 9-16, ⅞, 1 and 1½-inch Style "DD" Die-heads, the dimensions representing the maximum diameter of thread which each of these die-heads is designed to cut.

The construction is clearly shown in fig. 4. The dies are held on splines of liberal size at one side of the openings, in which they are a close fit, effectively preventing any relative movement, laterally or vertically. Their position with relation to the diameter of the thread to be cut is controlled by similar splines in the shape of cams "C" engaging the slots on the lower faces of the dies. As all four dies are adjusted simultaneously, and are solidly supported as close as possible to the cutting strains, they cannot move away from the work, and the greatest accuracy is assured.

The die-head is not held rigidly as in the case of a solid die, but is supported by a spring mechanism between the head and the shank, which permits the chasers to compensate for any inaccuracy of adjustment of the turret. In other words, the head yields as it comes into contact with the work, allowing the chasers to adjust themselves to the piece. At the same time, it provides for a certain amount of longitudinal movement, independent of the turret feed, allowing the chasers to compensate automatically for any slight irregularities that may exist, thus insuring a uniformly accurate product and eliminating wasters.

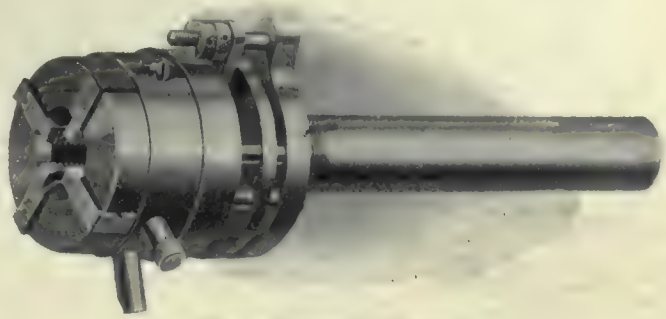


Fig. 1—Geometric Die-head.

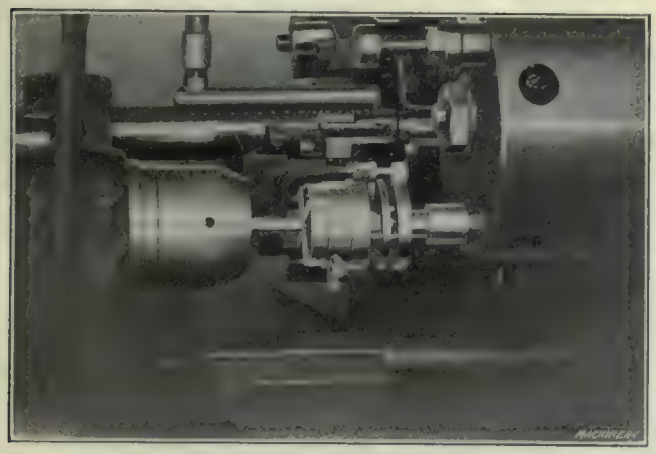


Fig. 2—Geometric Die-head.

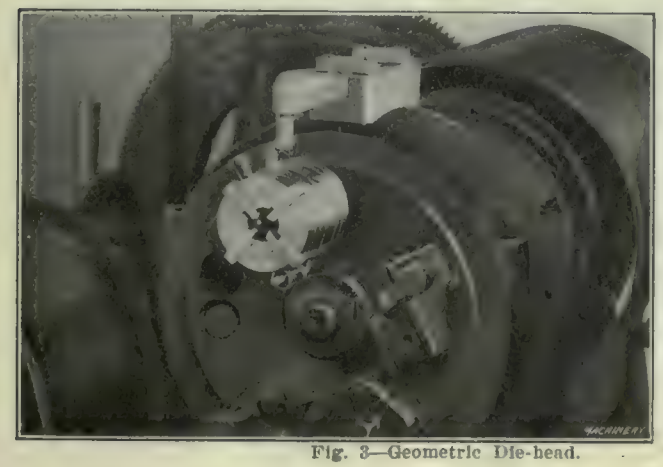


Fig. 3—Geometric Die-head.

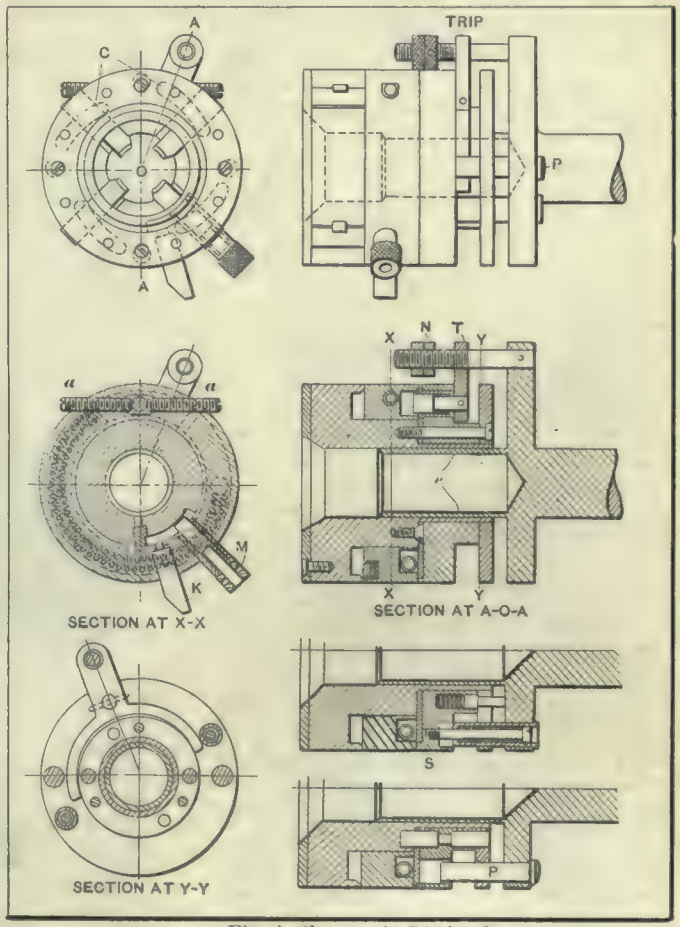


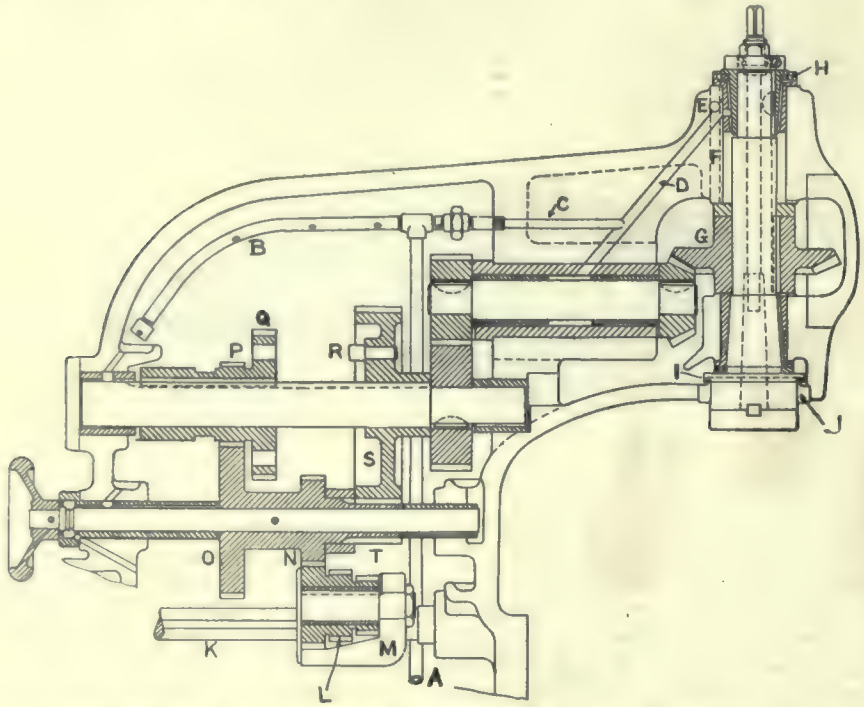

Fig. 4—Geometric Die-head.

The die-head is not mounted directly on the shank, but is carried on heavy driving pins "P," set into a substantial flange, integral with the shank itself. Further support is provided by a central extension "e" of the shank on which the head is free to move. The travel of the turret determines the length of thread to be cut, but this may also be set to closer limits by means of the lock nut adjustment "N" at the side of the die-head. When the turret reaches the limit of its travel, the die-head has a slight independent forward movement, which causes the lock nuts to contact with the hinged plate "T," releasing the locking bolt and opening the chasers. These lock nuts may be adjusted to allow more or less longitudinal movement, as required by the work, without operating the tripping mechanism. A micrometer adjustment, controlled by two accurately fitted screws, "a," is provided at one side of the head. By means of this, quick and accurate variations may be made in the diameter of the threads for a tight or loose-fitting screw, as desired.

As shown by figs. 1 and 4, the die-head is equipped with a closing pin, "K," designed to close the chasers automatically by the rotation of the turret in conjunction with a closing bar fastened to the turret housing, as seen in fig. 3. In fig. 2, the thread has just been completed, and the tripping mechanism is about to open the chasers, preparatory to moving back off the work. In fig. 3 the closing bar on the machine is making contact with the closing pin "K" on the die-head, thus closing the chasers ready for the next screw.

## VERTICAL SPINDLE MILLING MACHINE.

THE text and accompanying illustrations refer to a vertical spindle milling machine recently added to the product of the Kearney & Trecker Co., Milwaukee, Wis. It will be noted that there is considerable similarity between this and the horizontal type milling machine also made by this firm; the differences in driving and feed mechanisms having reference to dimensions only. The construction of the knee, saddle and table are also similar to the horizontal design, the knee being of box section without the usual slotted top. In this machine, a departure has been made from the usual practice in vertical spindle machine design of the knee type; the spindle depending entirely on the knee for its vertical adjustment.

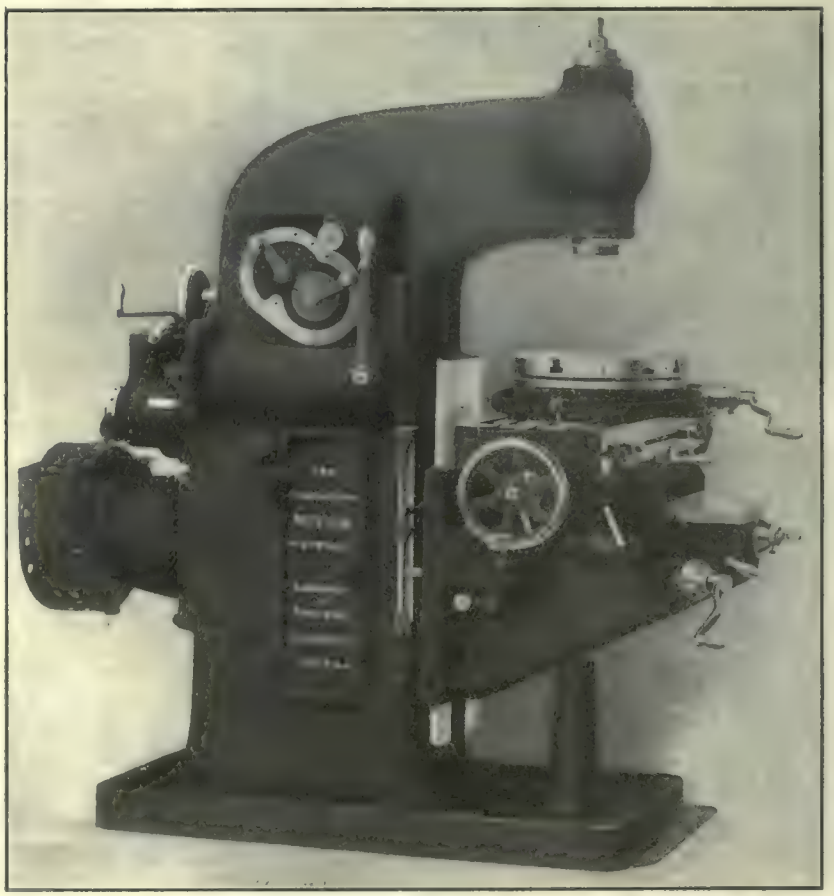



Vertical Spindle Milling Machine Detail.—The Kearney & Trecker Co., Milwaukee, Wis.

### System of Lubrication.

The system of lubrication is the same as that employed in the horizontal spindle machines, with the addition of necessary details to take care of the vertical spindle; much of the arrangement is wholly original. The line drawing shows clearly the construction of the spindle and the means employed for its lubrication. The boxes are bronze with the spindle taper on the lower end, and a sliding sleeve, also taper, on the upper end, which enables the wear to be taken up by the collar at the upper end of the spindle. The machine is lubricated through the pipe, A, the pump in the base of the machine being the simple spur-geared type.

It delivers oil to the perforated distributing pipe, B, which lubricates thoroughly all of the horizontal bear-



Vertical Spindle Milling Machine.—The Kearney & Trecker Co., Milwaukee, Wis.

ings and gears, these being so constructed that the oil cascades downward from one to another. It will be noted that these bearings are grooved in such a way that the oil can flow freely through them. This prevents any foreign substance in the oil from lodging in the bearings; the rapid flow washing out any such impurities. A hole, C, is drilled through the main casting by which the surplus oil flows into the passage, D. Engaging with this hole is a horizontal hole connection, E, with the vertical hole F. The hole, F, is plugged at the top, the object being to provide an overflow of the surplus oil, so that in effect a reservoir is maintained in contact with the upper bearings at the height of the hole E. The surplus oil, flowing through F, discharges onto the gear G, lubricating it thoroughly, from whence it flows downward through the horizontal bearings at the front of the machine, overflowing successively each pocket and cascading downward the same as for the back bearings.

The grooves in the upper spindle box are so constructed that the oil is carried upward into the annular groove, H, thoroughly lubricating both thrust collars and bearings. The oil discharged from the gear, G, flows through the lower spindle bearing on to the collar, I, and is prevented from running downward over the end of the spindle by the collar, J, which is made oil-tight in the main frame of the machine.

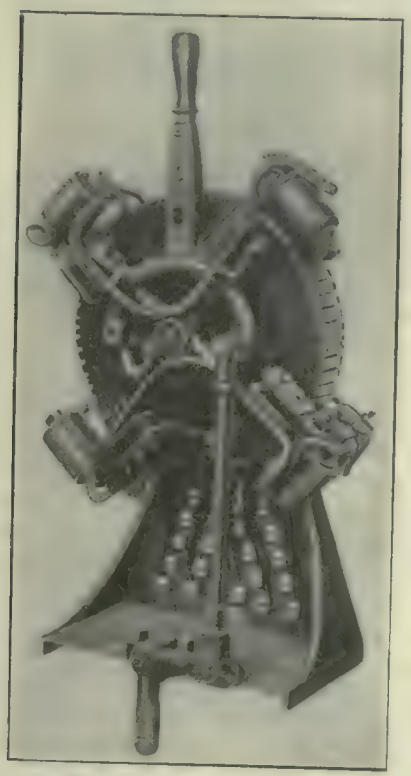
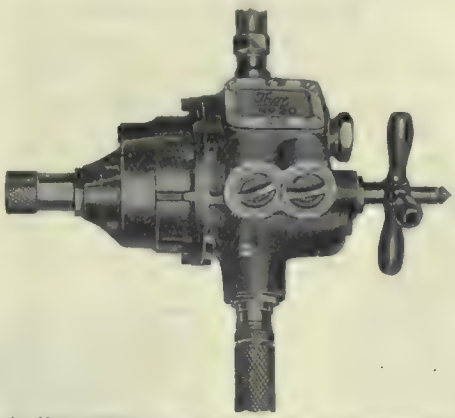


Fig. 1.—Front View of New Concrete "Grindstone" Crane Controller.

**Constructional Details.**

The front end of this spindle is of the firm's well-known flanged construction with hardened steel drive collar. This can be removed, and permits face milling cutters to be screwed solidly against the flat face of the spindle, which is always protected from injury



A New "One Man" Drill -The Independent Pneumatic Tool Co.

by the hardened collar referred to, and, therefore, maintains its accuracy. The machine has 18 spindle speeds in geometrical progression, running from 15 to 354 r.p.m.; these 18 speeds being obtained by the use of ten gears only. One of these is located on the shaft, K, which engages with the middle step of the three step cone, L. The latter is an idler carried in the swinging frame, M, which is supported on one side by the shaft, K, and on the opposite side by a pinion, so that there is no overhang whatever to the idler, L. The three steps in the idler, L, are arranged so that they can be engaged successively with the gears, N and O. This gives six changes of speed. The spindle sleeve gears, P, and Q, are arranged to engage with O and M, and also slide into engagement with the pin R on the large drive gear S, which in turn engages with the pinion T for slow rotative speeds. This again gives three changes of speeds, which, combined with the six obtained through the medium of the cone, L, gives 18 changes of speeds in all.

The machine has an automatic table feed of 24 inches, automatic cross feed of 12 inches and can be lowered 18½ inches from the end of the spindle; the vertical feed also being automatic. The work table has an operating surface of 11½ x 38⅜ inches. The rotary table is 14 inches diameter on the working surface, 18 inches diameter over the oil pan and is 5 inches high. The driving pulley is 14 inches diameter for 4-inch belt and runs 150 r.p.m. The pulley is protected by a neatly designed guard, made of perforated sheet metal, and is so constructed that it can be turned to any position around the pulley so that the belt may come from the line shaft directly overhead or from any angle, even to the extent of coming through the floor from a line shaft underneath. No countershaft is employed, since none is needed.

## A NEW "ONE MAN" DRILL.

THE Independent Pneumatic Tool Co., of Chicago, New York, Pittsburg, San Francisco and Atlanta, have recently placed on the market a new "One Man" drill, equipped with compound planetary gears, which is particularly adapted for drilling, tapping and screwing in stay-bolts and studs of all sizes up to 1¼ inches. Heretofore, such work required at least two and sometimes three men to lift and balance a portable machine with sufficient capacity to perform this work, a circumstance which accounts for the new and appropriate designation of "One Man" drill.

It is, of course, of the reversible type, weighs but 20 pounds equipped with a No. 3 Morse taper socket, and, like all "Thor" drills, has Corliss valves with which users are familiar.

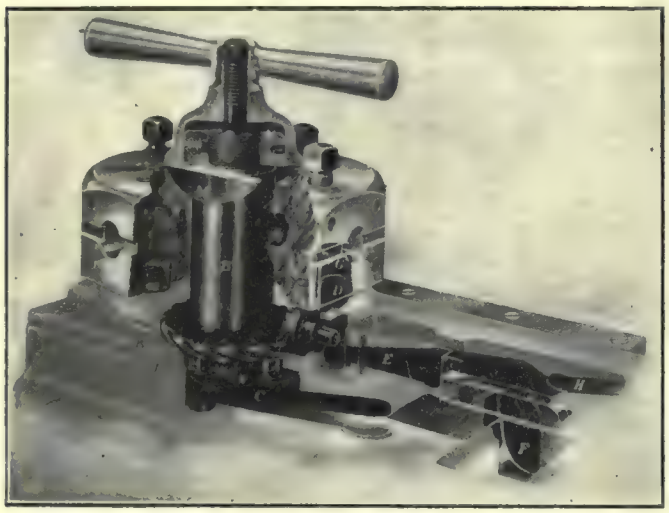
## A NEW CRANE CONTROLLER.

THE well-known "grindstone" type of controller used extensively in connection with direct-current motors operating cranes, hoists, steel mill machinery, etc., has proven eminently satis-

Fig. 2. Rear View of New Concrete "Grindstone" Crane Controller.

factory. It has recently undergone a refinement, however, which will still further increase its value by simplifying its construction and increasing its durability. As shown in the illustrations, the controller consists essentially of a cast iron frame on which is mounted a stationary disc carrying the contact pieces and cross connections. Pivoted to the center of the disc is the switch arm with four brush holders. The resistors can either be mounted on the frame or separate.

As a result of a series of experiments, the Westinghouse Electric and Manufacturing Co. has recently placed on the market controllers of this type in which the disc is made of concrete instead of stone. By a special treatment, the concrete disc is made a thorough non-conductor and at the same time moisture resisting. The use of concrete permits the cross connections between the segments to be made within the body of the disc, thereby giving the disc a "reinforced" concrete construction and at the same time producing a more compact piece of apparatus. The concrete disc with its self-contained cross connections also gives the controller a neater appearance than the older type.



Turret Indexing Mechanism—The Garvin Machine Co.

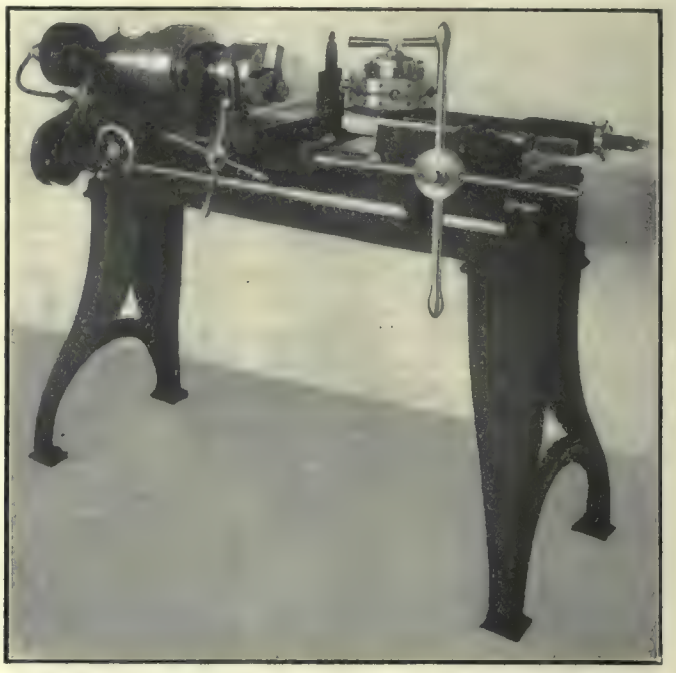
Figs. 1 and 2 are front and rear views, respectively, of the new concrete "grindstone" controller. In this particular piece of apparatus, the resistors are separate and not shown. The contact pieces are attached to the disc by screws in the same way as in the older type, and are as easily renewable. A blow-out coil of asbestos insulated wire is mounted on each brushholder to disrupt the arc formed in opening circuits.

## THE GARVIN No. 22 MONITOR LATHE.

THE machine shown herewith is a No. 22 Monitor Lathe regularly manufactured by The Garvin Machine Co., New York City. It is equipped with automatic power feed to the turret slide, which is under trip of individual stops, controlled by the rotation of the turret. It also has a cross slide, under adjustment by screw and hand wheel, shown located on the bed in front of the head, operated by the left hand. When the end motion is not needed, the slide can be securely bound to the guide-ways.

The special feature of the illustration is the automatic chuck equipment, which has proven to be a large labor saving outfit. Parts may be put in and taken out of the chuck in a very small fraction of the time it takes to operate the ordinary type of wrench chuck, thus reducing to a minimum the non-productive time consumed in operating a machine. As noted in the illustration, the air cylinder is at the rear end of the spindle; the pressure being let into this cylinder, forces the piston endwise. Directly connected with the piston is a rod reaching to the multiple wedge plug which operates on corresponding multiple wedge grooves, located in all three of the chuck sliding jaws. The chuck shown is what is known as the 6 inch, three-jawed, adjustable blank jaw. The grip is controlled entirely by the air pressure used. It is non-yielding, and always has a tendency to tighten. In handling delicate pieces proper reduction of grip can be arranged, by using a reducing pressure valve on the line of pipe between the source of supply and the operating valve.

The manufacturers are prepared to furnish spring operating mechanism for factories not equipped with air pressure. In a recent demonstration of the gripping power of the three-jawed chuck, operated by a heavy spiral spring, the chuck used being the 9 inch size, fitted to a No. 6 geared head turret lathe of standard make, a machine steel disc 8 inches in diameter and 1 inch thick, cut from bar stock, was inserted in the chuck jaws, and a 1¾ inch high speed twist drill was forced through the steel plate, followed by a second operation, wherein a grooving tool ¾ inch wide was let into the face of the blank on a circle of 7 inches diameter to a depth of ½ inch. This was, followed by a third operation, the cross slide tool taking a 3-16 inch cut off the entire face of the blank. Naturally the back gears were used, giving the full belt power to the cut. Frequently the belt would slip, showing that the grip of the chuck jaws was up to the full belt power of the machine. The pressure used for closing the jaws on the work automatically releases the brake and starts the rotation of the spindle. The removal of the pressure, either air or spring, stops this rotation and opens the chuck jaws to their full limit. Three-jawed chucks have been described above, but two-jawed chucks of various sizes and styles are furnished.



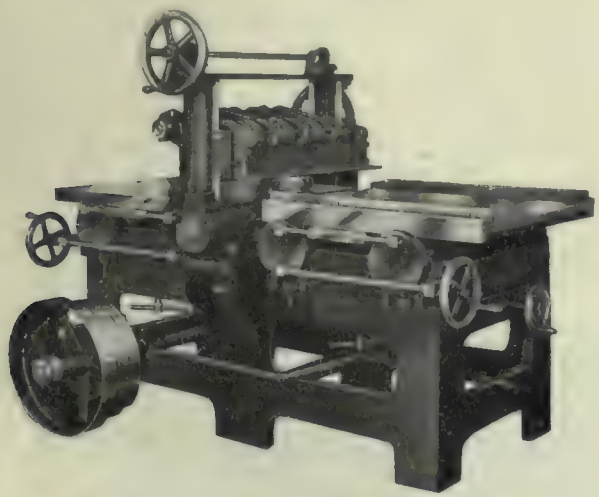
No. 22 Monitor Lathe—The Garvin Machine Co.

As it will be seen by the cut, the turret is of hexagon shape, having six flat surfaces with four capped-screw holes for securing rigidly either tools or fixtures to these faces. The turret rotator as now furnished on monitor lathes, is made of one piece as shown in letter B of accompanying cut. It is hardened and ground on the cylindrical fits, and is secured to the rotating turret by two Woodruff keys, shown by letter M in cut.

## THE FALLS PATENT UNDERCUT FACE PLANER.

WHEN the power-feed rip saw was first put on the market, it did not take long for progressive manufacturers to recognize its superiority over the old style hand-feed rip saw. Since the advent of the power-feed rip saw, another machine has been brought out. It is the undercut face planer, and as a labor saving device, bears the same relation to the hand-buzz planer, as the power-feed rip saw bears to the band-feed saw.

The illustration conveys an excellent idea of the general construction of the Undercut Planer. It will be noticed that there are four rolls, each acting independently of the other. This means that narrow strips, no matter how badly warped may be fed under each roll at the rate of 15, 30 and 45 ft. per minute, and the quality of the work will be absolutely perfect. Wide stock is worked in this machine as easily as narrow, the rolls being so designed that they get a grip on the board sufficient to carry it forward without exerting enough pressure to spring it down, even if the stock is so crooked that the cut is not carried all the way across the board. They rise and fall with its irregulatities and conform to the crooks in the stock.



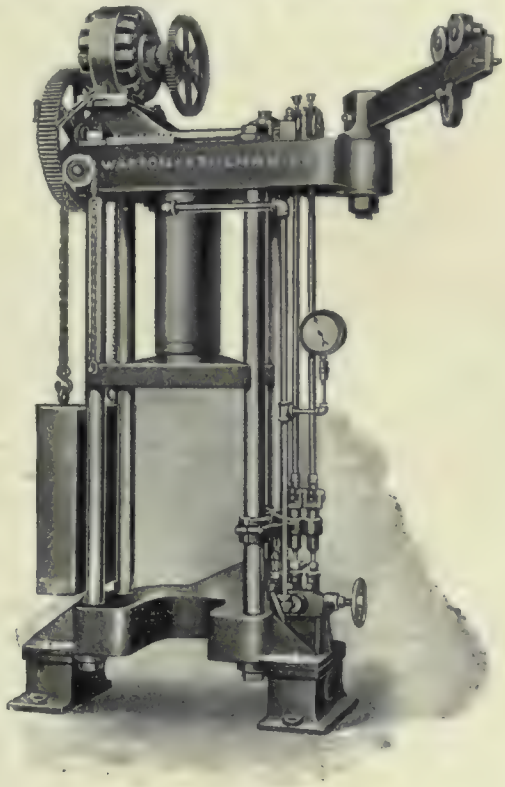
The Falls Patent Undercut Face Planer, No. 820.—The Canada Machinery Corporation, Galt, Ont.

The frame is heavy and cast in one solid piece, giving the machine a firm foundation. The large hand wheel adjusts the feed rolls to accommodate stock up to six inches thick on the regular machine; and up to three inches on the special short stock machine. The cylinder and spindles are a solid forging of high carbon-steel slutted on two sides. The arrangements for adjusting the tables is such that the edge is kept constantly within 3-32 of the knives, thus affording a good chip breaker. Other interesting features are the provision made for cutting hollow and crown points as well as surfacing stock, and the fact that the operator cannot get his fingers in the knives.

The machine is a product of the Canada Machinery Corporation, Galt, Ont.

## CONVENIENT HYDRAULIC LOCOMOTIVE BOX PRESS.

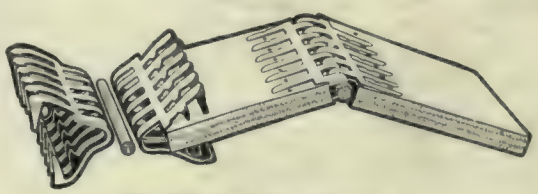
THE press which we illustrate herewith was designed for Mr. F. F. Gaines, superintendent of motive power of the Central Railroad of Georgia, and has proven very succesful for pressing journal box bearings into and out of place. It is also useful for broaching, key-seating, putting gears on shafts, pressing bearings, handling mandrels and general railroad shop work where heavy pieces have to be forced together. A crane bracket and beam are extended from one end so that the work may be swung into the press without hard manual labor. A back-geared motor mounted upon the pedestal on top of the press drives the pump shaft. Upon the other end of this shaft are two pump eccentrics. The pump pistons are both ¾ in. diameter by 2 in. stroke and the pedestal legs act as reservoirs for the pump. The operating valve shown is a single screw stem valve which releases the pressure from the work when open and starts the ram down when closed. A safety valve is used in connection with the pump to stop dangerous overload. The press, made in two sizes, 60 and 100 tons capacity respectively, and furnished hand or belt driven as desired, is built by the Watson-Stillman Co., 50 Church street, New York.



Convenient Hydraulic Locomotive Box Press—The Watson-Stillman Co., New York.

## ALLIGATOR STEEL BELT LACING.

THE requirements of every modern manufacturing plant demand the risk of shut-down to be not only reduced to a minimum as regards frequency, but at the same time, when the unavoidable does happen, that the period be restricted to the utmost in duration. Belt drives, from time to time, necessitate, due to repair requirements, it may be, either the stoppage of a single machine, a sectional group of machines



Alligator Steel Belt Lacing.

or perhaps the whole factory, should the main drive belt give out. In such circumstances, the enforced idleness means a lesser or greater loss, and naturally it is the part of wisdom to not only have efficient operative equipment ready for the emergency, but also such as is easily and quickly applied. The alligator steel belt lacing which we illustrate and describe, is claimed to fulfill both these purposes admirably, in addition to other attractive features. Official tests go to show that the "Alligator" joint has a strength equal to 60 or 70 per cent. of that of the best grades of belting procurable, and that the joint is in every respect, perfectly flexible.

Alligator steel belt lacing is adaptable for use on leather, rubber, balata, cotton or canvas-stitched belting, and consists of a separable lacing, hinging on a raw-hide or sectional steel rocker pin.

The flexible joint insures quick contact with the pulley, whether the belt is run with either or both sides in service, and as the lacing engages both sides of the belt alike, the strain is thrown in direct line of the pull, making a joint which is easy on the belt, and where applied according to directions will stand any belt strain, under any conditions of service. With rubber or textile belting this lace overcomes the tendency to fray at the ends, as the members of the lace clamp the stub so as to protect them. It will work perfectly in contact with an idler, and no punch holes are required.

The teeth on each side of the lacing enter the belt on different lines of perforation; each prong has two teeth, the longer clinching through belt, the shorter point on opposite side of prong giving great additional strength. Both enter the belt so that the pull is against the edge of the steel and not against the flat. This avoids weakening the belt, and in rubber and textile belts does not cut the long threads in which lie the strength of that class of belting.

Being separable, this lacing is especially adapted for use on overhead belts the ends can be dropped down, the lacing applied and hinge pin inserted after belt is returned to shafting; by taking out pin, belt may be temporarily removed from service, lengthened by inserting a stub section of belting or shortened by cutting off excess from one end and using half of a new lacing.

The connecting bar between the prongs is indented on the under side to allow it to be broken into required lengths (cutting pliers not being required) and the use of a single section on any width of belt up to 12 inch. The indentation also insures that in use over heavily crowned pulleys the bar may be broken without weakening the lacing, as each indentation separates a full staple which retains its efficiency.

The sectional rocker hinge pin consists of two specially formed steel wires having oval faces with lugs on back to fit in between loops of the hinge and keep it from working out. In service, the sections of the pin remain stationary in the loops of the lacing and give the necessary flexibility to the joint by rocking on their oval faces. When using the rocker pin, cut two pieces just alike, same length as bar of lacing, having small lug at one end; reverse one piece, put smooth faces together as shown in cut and insert in lacing with round back fitting the loops of lacing, having lugs between loops of hinge.

The "Alligator" steel belt lacing is made by the Flexible Steel Lacing Co., Chicago, and the Canadian agents are the Crescent Oil Co., Hamilton, Ont.

## BUILDING RAILWAY ENGINES AND COACHES IN NEWFOUNDLAND.

By Ben Brigden.

AFTER many years of railway service in the Island of Newfoundland, the Reid-Newfoundland Co. has, perhaps, reached its goal—that of constructing locomotives and coaches for use on its own lines throughout the island. This expectancy was realized a short time ago, as may be seen by the accompanying illustration, and to anyone familiar with the conditions appertaining to Newfoundland railways in days gone by, the present successful achievement and, necessarily, new industry established, are, certainly beyond the most sanguine expectations of the then few great railway philosophers in that territory. The recent opening of the newly constructed section of the Trinity-Bonavista branch line will serve as a further impetus to the undertaking, while the public, who travel, will have the pleasure of knowing that these added conveniences of civilization and their surrounding commerce are the handicraft of their fellow countrymen and the products of their own province.

It is only necessary, at this time to mention, in order to give our readers a general comprehension of the size and capacity of this locomotive that, in the face of the knowledge that Newfoundland winters are of an exceedingly vigorous and prolonged nature, to build, or even attempt to build, anything other than first class, or, to be still more precise, anything inferior to Canadian or United States manufacture, would be a step in the opposite direction to that which characterizes this progressive Reid-Newfoundland Company. The constructional details of this engine consist of the best material obtainable, and everything, with the exceptions of the springs, was turned-out in the Reid shops at St. John's, by expert mechanics. Other engines are in course of erection, and not only does this good work apply to "iron horse" building, but it also amply fits concerning the mail coaches and passenger cars that to-day are being built by the same energetic firm and distributed over their one thousand miles of road, which, figuratively speaking, encircles the whole country.

A Product of the Reid-Newfoundland Works, St. John's, Newfoundland.

## TRAINING PATTERNMAKERS.

The Board of Education of New York City has approved a resolution relative to an agreement between that body and the Patternmakers' Association of New York, for the training of patternmakers' apprentices in the evening vocational schools of the city. The Patternmakers' Association has agreed that it will direct its apprentices to attend the evening school and it is proposed that the courses of study be conducted by the regular teachers and the practical workers of the association.

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The Board of Governors of the University of Toronto has appointed Mr. George A. Guess to the position of Professor of Metallurgy in the Faculty of Applied Science and Engineering.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. VIII. FEBRUARY, 1912 No. 2


## A FEATURE OF INDUSTRIAL SUCCESS.

IT is a well established fact, and deeply imprinted in most of our minds through its continually operative effect, both as regards the individual employer and a corporation's managing directorate, that unless we keep at least abreast of the times in which we live, there is the gloomy certainty just right ahead, of our being completely swamped by and engulfed in the tide of industrial progress.

It is surprising to find, even in this comparatively new country, manufacturing enterprises being conducted along the most primitive, unsystematic, inefficient, and, of course, uneconomical lines, and with a settled determination to persist in following the well-worn groove still further. A self-satisfied state of being is apt to take possession of individuals and corporations because of their past and present achievement, and a too liberal rendering of the instruction, "take no thought of the morrow," seems to be the mainspring of their business code. While sympathising to some extent with this attitude of passive resistance adopted, it cannot be too strongly impressed on those concerned, that their chosen general policy is suicidal. We sympathise with and admire their passive resistance to the volleys of idle "clap-trap, small talk, empty and meaningless nothings," popularly, but erroneously known as "business maxims," by which they are assailed. An official desk plastered over with such "gems" as "do it now," "don't worry," "yesterday is gone, etc.," may be an impressive sight to some bubble chaser, but to the man who has a vision and reads aright the signs of the times, it looks much like a military general trying to conduct a campaign on a foreign shore without an "Intelligence Department." However, and to return to our subject, comfortable contentment and smug satisfaction with present conditions, large financial distributions of bonuses, dividends and salaries, without regard to an ample appropriation being set aside for pursuing research work, operate just as effectively in the "running to seed" process of the great and presently world-known concerns as does the small, obscure and "self-contentment-drugged" plant in its relative position.

Again, the individual attitude to secure the highest possible achievement must also be that of one with a vision. The ambition to be the bearer of the "Message to Garcia," and the putting of the ideal into practical effect is not attainable by making a billboard of your "den" and an curiosity of your personality. The future of the great industrial corporation, the moderate size or small factory, and of us the individuals contributing to and receiving from either in the shape of investment returns, etc., depends on the establishment of a mutual direct personal co-operation towards further development. Too many individual, industrial corporations, large and small, simply sap and undermine the very foundations of their near future existence by pursuing a policy whereby every cent of profit is demanded on the score of "being only right and just," and too few corporations realize, that unless research and experimental work is amply provided for and diligently prosecuted, the succeeding few years will find them stranded and unable to compete in their particular line. Too many shareholders are so supremely selfish and so painfully ignorant of the laws of cause and effect, that they are prepared to adopt tactics, crude, coarse and even cowardly to secure their pound of flesh. Again, too many employees forget that busy times are not always prosperous times. A large output of machinery or a factory employed night and day throughout the year does not necessarily imply an increased revenue for distribution. On the contrary, it may have been all in the other direction. Employees should, therefore, realize that it is their duty to study diligently the situation so far as their contributory help affects, with a view to disclosing whether the granting of a larger share to them in the form of increased wages, is going to materially injure the company's competitive capability.

If directors, shareholders, and employees showed less suspicion of one another, if they would peer into the future a little more and get a glimpse of the trouble ahead which mutual consideration for each other's interests could easily circumvent, there would be fewer labor disputes, an entire disappearance of the grouchy shareholder, and a less bristly part for the management to tread in successfully meeting competition.

## EDITORIAL INDEX FOR 1911.

THE attention of subscribers is drawn to The Canadian Machinery editorial index for 1911, inserted at the rear of the present issue. By opening the binder clips on the last page—that facing the inside back cover—the index may be withdrawn for filing or binding along with the numbers for the year to which it refers. On closing the binder clips again, the current issue is kept intact.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

WHEN the Tropenas converter was introduced and success assured, it was believed that the steel casting industry had about reached the top notch. Although unable to compete with the open hearth furnace on large castings, for the smaller lines of work the converter could produce steel superior to that of the open hearth. Each system was, therefore, practically in a field of its own. Now, however, with a better understanding, cheapening and controlling of electricity, attention has been drawn to consider the electrical furnace as a still more efficient medium for the production and refining of steel.

About 15 years ago, in a plant where the writer was employed, an attempt was made to melt grey iron in the cupola by electrical means, instead of coke. Sunday was the day selected to try the experiment on account of the fact that the whole power of the plant was required for the purpose. It is not necessary to go into details, further than to say that iron was melted, but so sluggish was it that pouring from the ladle, much less the pouring into a mold, was impossible, Since that time a number of electric furnaces have been designed and, in their operation have given excellent results by producing high grade steel at phenomenal low cost. At an additional cost of $1 per ton, they can transform the most common Bessemer iron into best quality iron suitable for car wheels or automobile and small marine engine cylinders. In fact you can produce just what you desire and know what it is before taking it from the furnace. It is the most practical method for reducing sulphur, and at the same time for obtaining a strong close-grained yet soft iron suitable for machining.

### The Gronwall Electric Furnace.

One of the most efficient types of electric furnace up to the present time is the "Gronwall," invented by Messrs. Gronwall, Lindblade & Stalhane, three Swedish engineers of Ludvika. This furnace has some very distinct features, not embodied in others. The two-phase current arc type has been adopted, a procedure exactly opposite to the induction system. Electric furnaces differ from all others in that they receive their heat from mechanical sources, those of the open hearth and converter being heated from a chemical combination. In the mechanical method, you can control the elements of your mixture with certainty, whereas, in the chemical, everything depends upon the nature of the fuel used. Again, comparing the electric furnace with the crucible, there is a bath wherein you can make additions of refining slag so as to make steel to suit any specification desired.

A general view of the Gronwall furnace is shown in fig. 1. It will be noted that there are two carbon electrodes hung perpendicular, being a means of additional strength, compared with some types which have the electrodes hung at an angle inside the furnace, where with the intense heat they become soft and liable to break and drop into the bath of metal. Such a contingency would raise the carbon content and practically make the steel into cast iron, unless the carbon was withdrawn before it dissolved; otherwise, additions of ore and scale, to reduce the carbon present, would have to be made, as in the open hearth furnace, necessitating subsequent deoxidation of the steel before being poured. The vertical electrodes seldom break. The average analysis of the Amphorus Carbon Electrodes is as follows: Carbon, 96 per cent., ash 2.80 per cent., sulphur, .80 per cent. These electrodes are provided with screwed joints, so that they can be fed into the furnace continuously, the consumption being about 100 pounds per charge of a 5 ton furnace.

Their size is 14 inches sq. by 6 feet long, and 1.57 sp. gr. Each electrode is independent of the other, so that if anything goes wrong with one, the other can run the furnace. If arranged in sets, any single unit interference means complete shut down. The current passes from the electrodes to the slag or the metal in the bath, forming

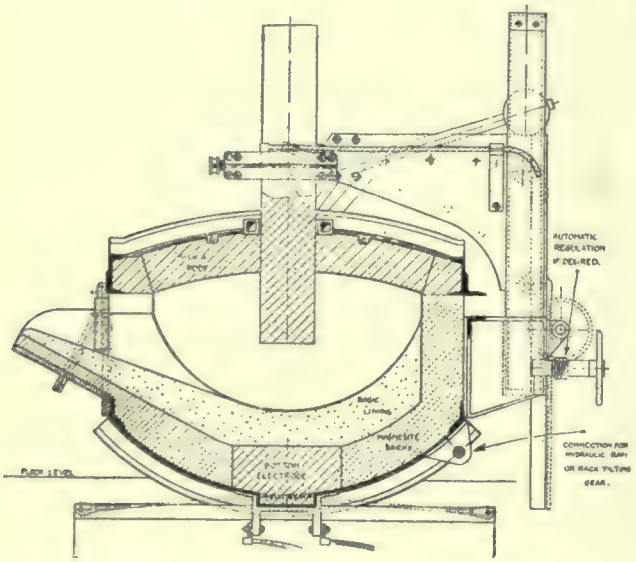



Fig. 2.—2½ tons capacity, electro-metals steel refining furnace—cross section.

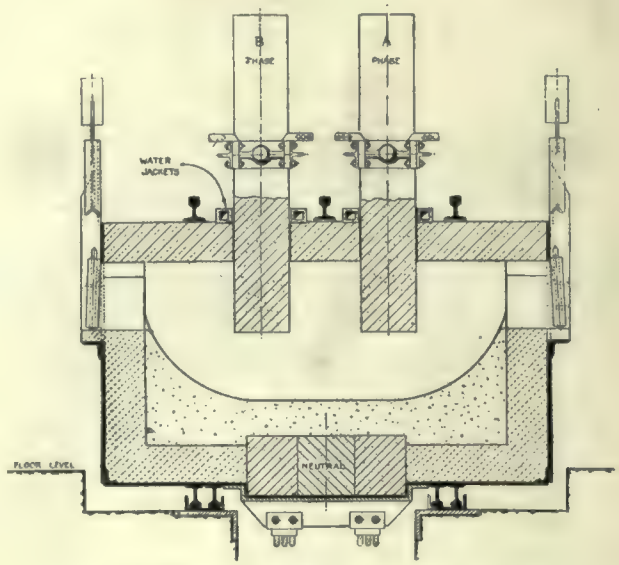



Fig. 3.—2½ tons capacity, electro-metals steel refining furnace—Longitudinal section.

an arc, then through to the basic lining on to a carbon block at the bottom of the furnace.

The main shell of the furnace is built of boiler plate and magnesite brick lining, with a hearth of dolomite rammed therein as in figs. 2 and 3. The roof is made of channel iron in the form of a frame, to hold the silica brick. It is separate from the other lining, so that when repairs are required to the roof, it affects nothing else. Working doors are provided at each end, also at the tapping spout, of a size to suit the requirements of charging. This can be either hot or cold, and if a very large piece is wanted to be disposed of, the top can be lifted off altogether and quickly replaced. At the back of the furnace there is a rachet arrangement for the regulation of the electrodes. This may be done by hand or automatically as desired. The loss of electric energy is reduced to a minimum by the method of gripping the electrodes quite low down. The furnace is tilted by hand or by power, electric or hydraulic. The electrical equipment has been properly taken care of, and there is little difficulty in reducing a high tension to 50 or 70 volts.

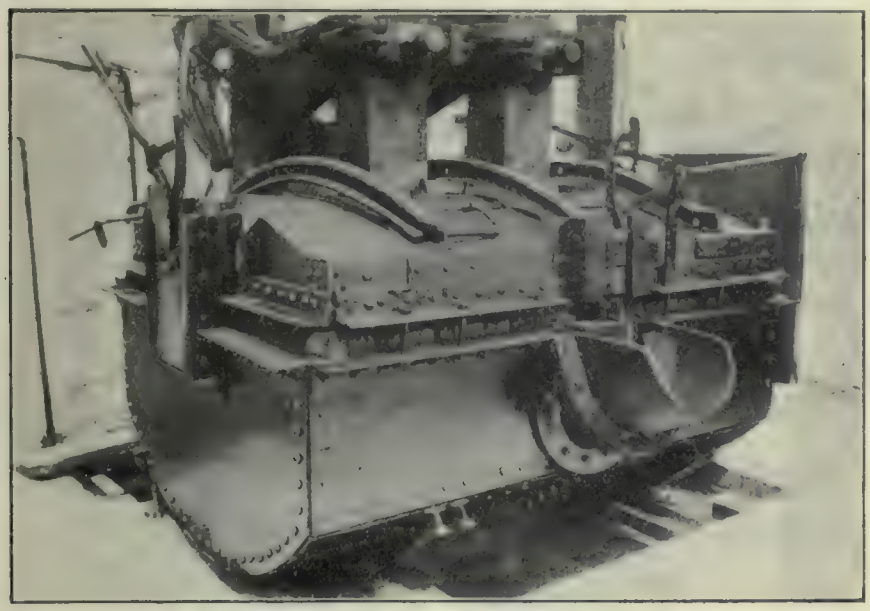


Fig. 1.—2½ tons capacity, electro-metals urnace.

### Electric Iron Smelting Furnaces.

The same engineers have also designed and patented an electric iron smelting furnace of the cupola type, using charcoal as a reducing agent. This to all appearance is going to hold its own in the manufacture of pig iron, and I believe will be a commercial success especially in Canada where there is such abundance of ore, but so high in phosphorus that it cannot be used in the manufacturing of steel. There are other designers in Canada working along similar lines but as their efforts are still in the experimental stage they cannot at this time be discussed. I have appended the latest report of the Trollhattan furnace operation.

### Trollhattan Furnace Operation.

As might have been expected, the first six months' working suggested various alterations in the construction of the furnace. It was, therefore, shut down at the beginning of June last, for the carrying out of these alterations. The plant was again started during the first week of September, and has been at uninterrupted work ever since. During the week from September 3 to September 9, the following results were obtained :—

| | Tons. |
|---|---|
| Pig-iron produced .... .... ..... | 131.4 |
| Quantity of slag .... .... .... ..... | 22.1 |
| Charcoal used per ton of iron ..... | 0.336 |
| Pig-iron produced per kw.-year .... | 5.05 |
| Pig-iron produced per h.p.-year .... | 3.79 |
| Current consumption per ton of iron | 1.736 h.p.-hours. |
| Power consumption per ton of iron.. | 2,351 h.p. hours |
| Average load .... .... .... .. .. | 1,357 kw. |
| Average $CO_2$ contents in the gas (by volume) .... .. ..... .... | 30 per cent. |

The current and fuel consumption depend, of course, to a large extent on the quality of the ore. The results for a protracted period during which the same kind of ore was used are, therefore, of interest.

WORKING RESULTS.

| | Sept. 3rd to Sept. 30th. |
|---|---|
| Pig-iron produced, tons ..... | 537.9 |
| Quantity of slag, tons .... ..... | 88.9 |
| Iron in the ore, per cent. .... ..... | 67.65 |
| Iron in the ore and lime, per cent... | 65.02 |
| Quantity of slag per ton of iron, kg. | 165 |
| Charcoal used per ton of iron, kg.... | 339.9 |
| Average load, kw. .... .... ..... | 1,407 |
| Average power, h.p. .... .... ..... | 1,913.5 |
| *Current used per ton of iron, kw.-hours .... .... .... .... ..... | 1,749 |
| †Iron produced per kw.-year, tons.. | 5.01 |
| Iron produced per h.p.-year, tons... | 3.68 |
| Average $CO_2$ contents in gas, per cent. .... .... .... .... ..... | 29.27 |
| Average analysis of iron :— | |
| C, per cent. .... .... .... ..... | 3.64 |
| Si, per cent. ..... ..... ..... | 0.36 |
| Mn, per cent. .... .... .... ..... | 0.40 |
| S, per cent. .... .... .... ..... | 0.009 |
| P, per cent. .... .... .... ..... | 0.018 |

*According to instruments at the furnace.
†Estimated on the basis of 8,760 kw.-hours per kw.-year.

Comparing these figures with the earlier results, it will be seen that a great improvement has been obtained over the first six months' working results. Per ton of iron there were then used from 2,150 to 3,800 kw.-hours, and for the entire time an average of 2,391 kw.-hours. The ores then used varied somewhat in quality, but it will be seen that a reduction of 20 to 25 per cent. has been effected in the current consumption. Correspondingly, the output of pig-iron per kw.-year has been raised from an average of 3.66 tons to over 5 tons. The charcoal consumption has been reduced from 418 kg. to 340 to 345 kg. per ton of iron, and the electrode consumption has also been reduced. The electrodes now used are supplied by the well-known Planiawerke, and are provided with screw joints so that there are no waste stumps.

The practical importance of the process is best proved by the fact that there are now built or building furnaces for an aggregate of 27,000 h.p., while, in addition, furnaces for about 36,000 h.p. are projected.

### NEW APPOINTMENT.

Mr. W. H. Maybank for a number of years foundry superintendent of the Ornamental Iron Department of the Canada Foundry Co., has associated himself with the Dominion Foundry Supply Co., Ltd., of Toronto and Montreal, in the capacity of traveling salesman. Mr. Maybank is a practical man, and is prepared to give the benefit of his brass and iron foundry experience to those in need of same. The Toronto branch still remains under the management of Mr. F. J. Ross.

W. H. MAYBANK.
Representative, The Dominion Foundry Supply Co., Toronto and Montreal.

## THE NEW MUMFORD VALVE FOR JOLT-RAMMING MACHINES.

EVERYONE having experience with jolt ramming machines has appreciated the presence or bemoaned the absence of simplicity in their design.

In the case of jolt-ramming machines, the familiar adage that "nothing is stronger than its weakest part," might well be paraphased to "nothing is tighter than its loosest part." The constant fierce shocks to which all such appliances, whether "shockless" or otherwise, are subject, put simplicity at a premium, for everything about them is struggling for freedom to desert its post. What happened in the story "for want of a nail" was hardly more tragic than what often happens for want of a nut or a pin in a busy, jarring-jolt-ramming machine.

### Simplicity of Jolt Ramming Machines.

Jolt ramming machines, per se, are essentially simple:—An anvil, upon which a table, raised by a plunger attached to it, falls to ram a mold, is the whole story, excepting—the account of the valve. The early jolt-ramming valves had in them a piece for each function. No particular inventive faculty is requisite to think of a hook to hang one's hat on—more hats more hooks, that's all. So, it is easy to open something to let the air out and open something to let the air in and shut something else to keep it there; then add a spring, a tappet, a cam or a lot of handy things that may be had without much thought to manipulate these various features. When such a valve is new, it is often as imposing as a brass band, drum major, etc. But, what after all is it? Not unlike the wonderful dog kennel with a little hole for the little dog and a big hole for the big dog.

Valves have been designed to enable the operator to change the stroke of a jolt-rammer while ramming. Result—a useless thing done, and costly, trappy, useless parts to do it. The stroke of a jolt-rammer need never be changed. Give it a stroke long enough to ram the hardest mold, hard enough, and arrange it so that the blow may be modified at will by varying the back pressure on the plunger to give the gentlest blows needed. The operation of the valve will be understood from the following reference to the sectional view of a 24 inch jolt-ramming machine with 72x72 inch table, and capacity to ram molds weighing twelve tons.

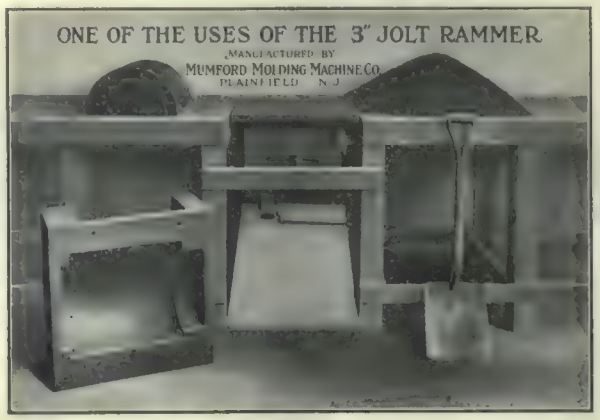
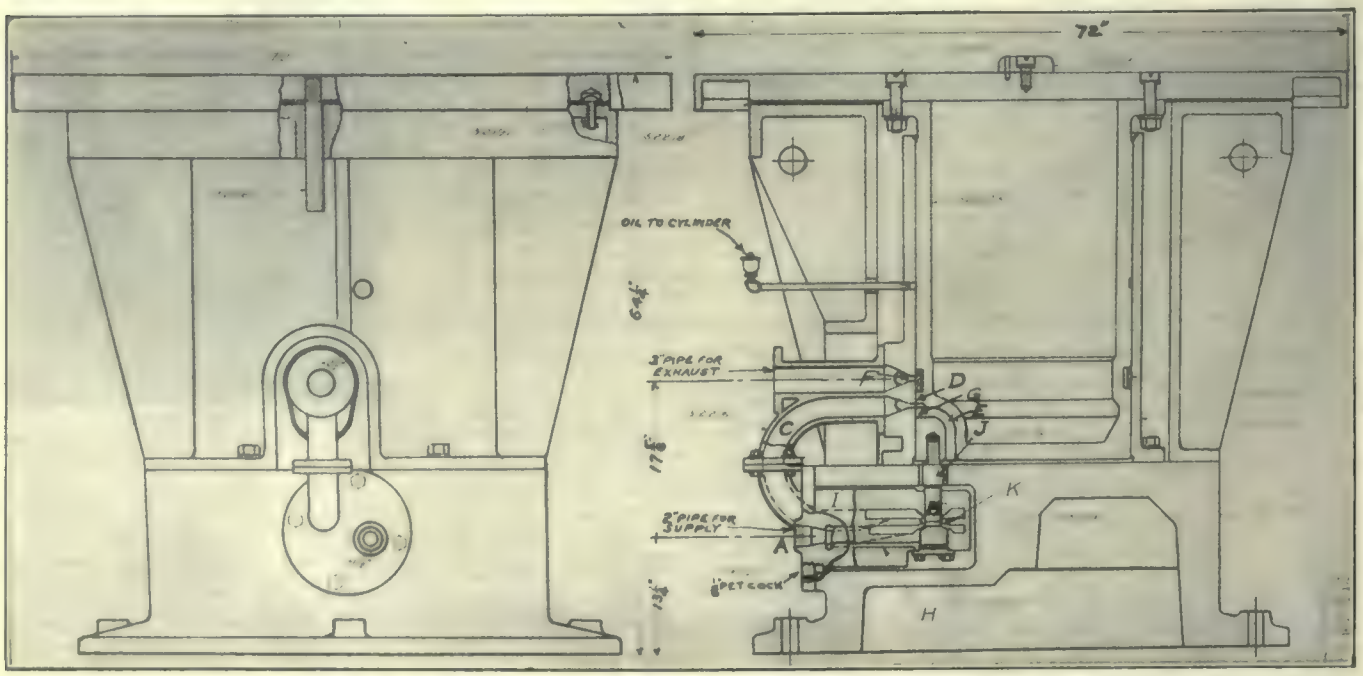



Fig. 2.—3-inch Jolt Ramming Machine on Core Bench, with Knee-pad Operated Valve.

### Valve Operation.

Air entering at A passes around the stem of the valve B to the bent tube C. From this tube it enters the space in the side of the main plunger at D. Through the port E it reaches the cylinder and raises the main plunger with its mold table. As the lower edge of the packing ring on the main plunger uncovers the exhause port F, the rising shoulder G of the main plunger obstructs the entering air. With the exhaust open and entering air blocked off, the pressure falls rapidly under main plunger, and while table is falling to impact, valve B blows up into the reduced pressure in the cylinder and closes positively the entrance of air. The pressure which forces valve B up is line-pressure introduced through the by-pass H, and this pressure holds B up, with air cut off, until, just before

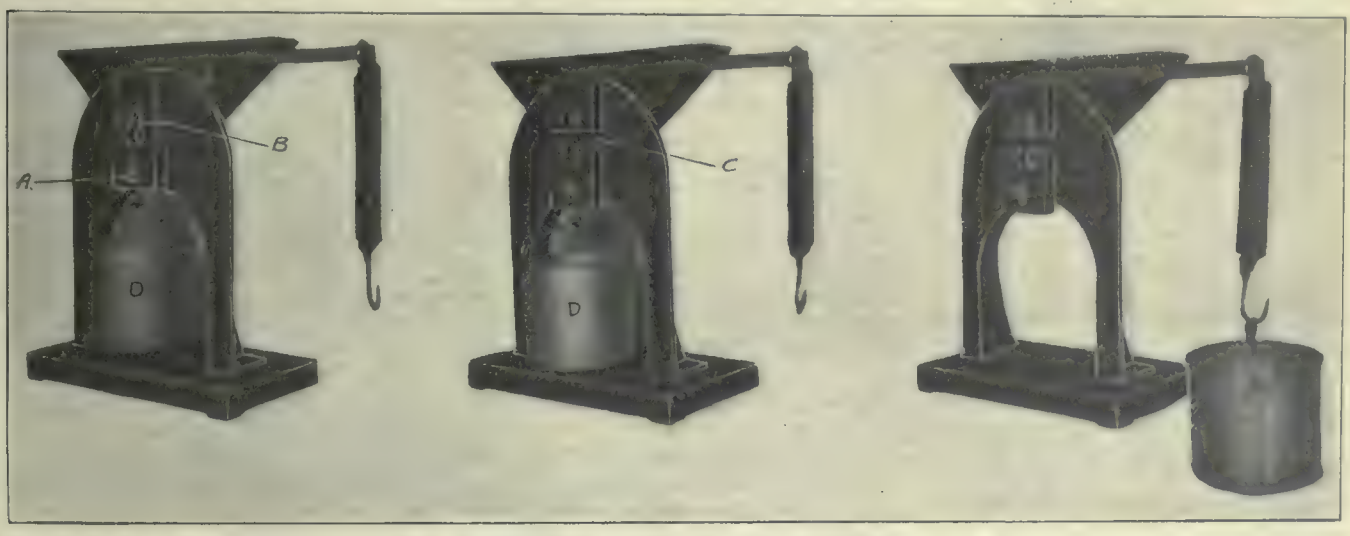



THE NEW MUMFORD VALVE FOR JOLT-RAMMING MACHINES.

impact, the projecting part J of the main plunger forces valve B open and re-admits air for the next blow.

Thus it is seen that the valve of this jolt-ramming machine is unique in that it is actuated by the air independently of the velocity of the rising table, without imposing any burden upon the entering air column. In this it is differentiated from those valves which require that the machine shall have enough reserve capacity to send the table **past** a valve-throwing-point with velocity sufficient to complete the operation and not stall with valve partly thrown. For the above reason, these machines are claimed to give higher capacities than machines with the other valve types. The total absence of springs in the valves or elsewhere in these machines eliminates a source of trouble usually present wherever springs occur. Moreover, simple and sure as is the working of the valve B, it is carried in a readily removable plug I, so that even unforeseen accidents are provided against.

A 3 inch machine of like construction is shown in fig. 2, in quite a usual setting, on a core bench with knee pad operated valve.




THE WADSWORTH CORE TESTING MACHINE.
The first cut shows the machine ready for opening the valve. The second cut shows the test piece broken, and the third cut shows the amount per square inch taken to break it.

## A CORE TESTING MACHINE.

FOR many years there has been a demand for some practical means of comparing the strength of various core binders. It is also often important to be able to compare the strength of different core mixtures as affected by changes in sand, oils and binders.

### Experiments on Core Mixtures.

Some five years ago, George H. Wadsworth started a series of experiments on core mixtures. The work was carried on jointly by George H. Wadsworth and H. M. Lane, but was dropped for the time on account of lacking the equipment for making accurate determinations. During the past year the work has been taken up once more, and a number of manufacturers have collaborated to carry it through.

During the experimental work, a number of different methods of testing cores were tried. Broadly, the choice lay between a tension and a transverse test. In the case of very strong cores, such as oil sand mixtures used for radiators, some classes of fitting cores, gas stove burners, etc., the transverse test on a one-inch square core 15 inches long gave fair results, but it was difficult to turn out these large cores in quantity without rods, and to be sure that they would not contain mechanical defects which influenced the strength. Then, too, the transverse test on bars of this length was not delicate enough to give a comparison between mixtures of approximately the same strength.

In testing the tension methods, an ordinary Fairbank's cement testing machine was first employed, and this was found excellent for very strong core mixtures, but was not delicate enough for the weaker mixtures common in grey iron, brass, and malleable foundries. There is on the market a small machine operating on the spring principle which was tested for this purpose, but as its price was fairly high and its capacity limited to 50 pounds per square inch, it was not found universally satisfactory, and hence the new Wadsworth Core Testing Machine was developed, as shown in the accompanying illustrations. The core used is the shape of the ordinary concrete briquette, having an area of one square inch in the centre. The core is placed between the jaws when they occupy the position shown at the left, the jaws being closed together as shown at B. The illustration, however, does not show the core in place. The pail D is hung to the lower jaw so that it is supported by the core. The hopper E is filled with shot, and by raising the pin A to the top of the slot in the jaw a small gate at the bottom of the shot hopper is opened and the shot allowed to flow into the pail D. As soon as the weight of shot in the pail becomes sufficient, the core breaks and the jaws separate as shown at C in the central view. As the lower jaw decends, it carries with it the pin A, thus automatically closing the shot valve. The jaw, however, is so arranged that the pail and jaw remain supported upon the pin A without coming in contact with the base of the machine. The pail is then lifted off and hung on the spring balances, as shown at the right of the illustration. To get the full weight which it took to break the core, the lower jaw must be placed in the pail, or a weight equivalent to the jaw must be placed in it. This gives a direct reading of the weight necessary to break the core. As soon as the reading is taken, the pieces of the core are removed from the jaws, the shot poured back in the hopper, another core inserted, and the pail hung on once more, as shown at the left. The operation is very rapid, so that it is possible to test at least two cores per minute with ordinary mixtures.

### Practical Use of the Machine.

The practical use of the machine is as follows: If it is desired to test a new lot of sand oil, or binder, two batches of cores are made with the same sand, one using the old binder and the other the new, in the same ratio. These cores should be baked on the same plate in alternate rows. They are then taken out, allowed to cool, and broken. The baking temperature will have consider-

able effect on the strength of the core. but it will affect both samples alike, so that with this method of procedure a. exact comparison of the strength of the two binders is possible. It has been determined that variations in the clay content of the sand, and amount of dirt in the sand, or in the shape and size of the sand grains themselves, may have a marked effect on the strength of the core, and hence every new lot of sand should be tested as it comes in. To accomplish this, take samples of the new and old sand, and make with them two lots of cores from a standard binder, as, for instance, a sample of core oil kept for the purpose. These two sets of cores should be baked on the same plate and tested as already described.

A check on the regular running of the foundry may be secured by having one or two plates of test cores made from the regular mixtures each day and baked with the regular cores. If the ovens are running either too hot or too cold, these test cores will not develop the strength they should. This gives the core room foreman an absolute check on the man who is firing his ovens, and on the man who is making his mixtures. It is possible to control the strength of the cores within very narrow limits, but this is not accomplished in the practice of ordinary core rooms to-day, and in these irregularities both as to mixtures and temperatures, lies the cause of great variations and loss of castings, due to irregularities in cores. If the poor cores are sorted out before they go to the molding floor, the firm is still out of pocket an amount equal to the material contained in the cores, including both sand and binder, the coremaker's labor, the core oven fuel, and the necessary expense of handling. The use of one of these testing machines will afford a quick and inexpensive means of checking the daily core room practice. The machine is manufactured by The Wadsworth Core Machine & Equipment Co., Akron, Ohio.

## BLAST FURNACE GASES.

IN his presidential address delivered before the West of Scotland Iron and Steel Institute, Mr. Walter Dixon said "that it was now recognized that blast furnace gases used in gas engines could develop not less than twice the power which was capable of being developed in steam engines using gas-fired boilers, and it was a question for each particular works to decide how far, and to what extent, they were justified in using their gas as at present, in an admittedly uneconomical way, or how far, and to what extent, it was reasonable to avail themselves of the demonstrated possibilities of gas power. The case was different with foreign competitors. With them blast furnaces were generally associated with steel and other works requiring power, and the rapid increase in the number of gas engines now employed on blast furnace gases showed to what extent the possibilities had been recognized. The distribution amongst various countries of 1,033,509 b.h.p. of large gas engines was :—Germany, 46.5 per cent. ; America, 32.5 per cent. ; France, 5.4 per cent. ; Belgium, 4.6 per cent ; Austria-Hungary, 2.4 per cent. ; Great Britain, 2.4 per cent. ; and other countries, 6.2 per cent. Of this power, 84 per cent. was employed in iron and steel works, 6 per cent. in collieries, 3 per cent. in electricity works, and 7 per cent. in other directions. In his opinion the reason for the advance in the adoption of the gas engine on the Continent and in America was largely the advent of the electrically-driven reversing rolling mill, which practically dispensed, with steam, and at once opened the way to a large economy by the practical elimination of the boiler range and the utilization of the available gases to the full.

A steel works should not and could not depend safely on a large and regular supply of power where only two or three blast furnaces were in use, as the working of the furnaces would not be sufficiently regular nor the gas sufficiently constant either in quality or quantity. These difficulties could be overcome to a large extent by the introduction of a comparatively inexpensive gas producer plant to act as a stand-by. In such a way it was possible that the fullest use could be made of the gases from a small number of blast furnaces to furnish the necessary power in an adjoining works ; but how far such methods could be applied economically depended in each particular case, on the value and condition of the existing steam raising plant and the cost which would be involved in replacing the steam by gas-driven plant. Steel makers abroad obtained their power, practically speaking, for nothing, while in many British works, almost every horse-power must be developed by the actual utilization of coal in steam boilers.

The question was, how could this coal be used to the greatest advantage ? The time had surely passed when a British steel-maker should hesitate to generate his power by gas engines. Many works now depended successfully on such engines, and it might be taken as a fact that a properly equipped gas engine station, on modern lines, was as trustworthy as any other type of station. It was also true that, horse-power for horse-power, the power could be raised by this method for, say, one-half the coal that was being expended at the present time in the case of boiler firing. Gas engines up to 5,000 h.p. could now be obtained to give out one-horse power for about 1¼ lb. of coal, which coal could be gasified in producers of simple and inexpensive type. In this way, economical development of power should demand careful consideration, even where blast furnace gases were not available.

### Gas Producers.

There was, however, another means by which the cost of energy could be further reduced—by the introduction of gas producers coupled with ammonia recovery and by-products plant. The recovery of by-products marked an era in the economies of blast furnace operations, and it equally marked an era in the economy of steel works practice. Such plants had been already installed in several important works which had not the advantage of being connected with blast furnaces. The gas was raised from producers with which an ammonia recovery plant was connected, and from each ton of fuel so gasified, sulphate of ammonia of a gross value equal to, or exceeding, the original cost of the coal was being obtained continually,—probably the nearest approach to "gas for nothing" which would be obtained by any method other than a blast furnace plant. In either process, apart from the cost of the plant itself, the energy in the fuel might be considered a by-product, while continuous rolling mills were being driven direct-coupled to gas engines, and a large part of the auxiliary machinery was being worked electrically from power so generated.

**Harold Smith,** production engineer for the Canada Foundry Co., Toronto, has accepted a position as assistant superintendent of Mather & Platt's whole plant, at Park Works, Manchester, Eng. Previous to coming to Canada he was in the employ of this latter firm for 10 years, 4 of which were spent in the capacity of shop superintendent of the electrical department. In addition to his recent appointment with the Canada Foundry Co., Mr. Smith was for two and a half years and one year respectively, superintendent of the Montreal Light, Heat & Power Co. repair and manufacturing shops, and that of the Canadian-Crocker-Wheeler Co., St. Catharines, Ont. Mather & Platt have during the last 10 years been rebuilding, re-equipping and reorganizing their whole plant, provision for same having been made by the purchase of 40 acres of land 2½ miles outside Manchester. The firm employ from 1,200 to 1,500 men, and while claiming to be the largest turbine pump manufacturers in Europe, they, in addition, do an extensive business in all manner of fire, hydraulic, electrical, mechanical and textile machinery. Mr. Smith sails for England early in February.

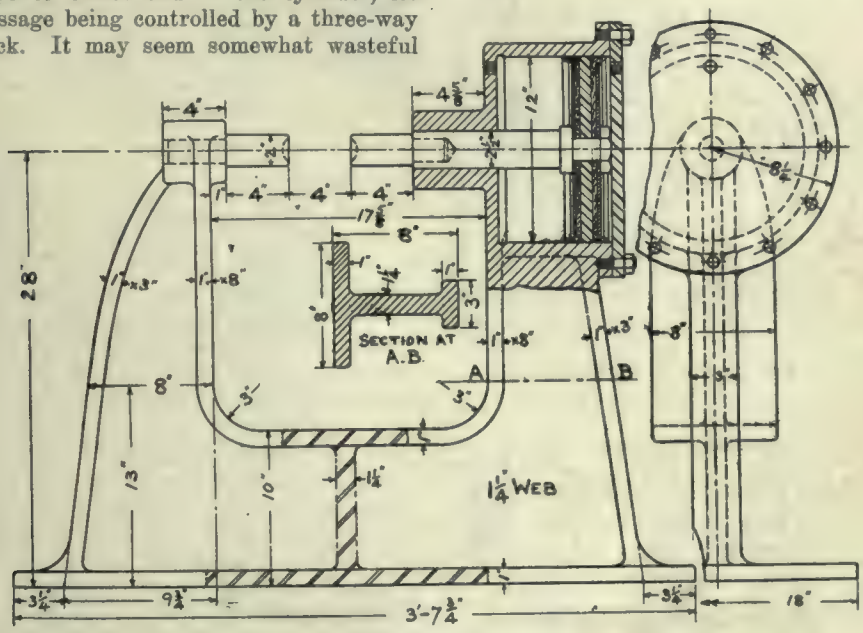
# MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

## SMALL PNEUMATIC GAP RIVETER.

By J. Harcourt.

THE 18-inch gap riveter here shown was designed for riveting rough, light plate work where a pressure tight joint is not required. It operates under an air pressure of 115 pounds per square inch and is capable of closing rivets up to and including ½ inch diameter. The cylinder and yoke form a single grey iron casting, the stresses in which were kept fairly low in order to secure rigidity when riveting. Thus, under the air pressure above referred to, the maximum fibre stress in the compression flange is about 5,900 pounds per square inch, while in the tension flange it does not rise much above 2,600 pounds. The riveter has a base 18 inches wide, and is bolted down to a light concrete foundation. Air is admitted by a ½-inch pipe to either end of the cylinder, its passage being controlled by a three-way cock. It may seem somewhat wasteful to use air for returning the piston to the beginning of its stroke, but the action is thus made much quicker and more certain than would be the case if a spring were employed for the purpose. Leakage past the piston is prevented by two cup leathers clamped to the ¾-inch steel plate, which forms the main piston, by means of two light follower plates and set screws. The cylinder cover is also made of ¾-inch steel plate and is attached by twelve ⅝-inch studs. A ram, or piston rod, 2½ inches diameter guides the piston and carries the moving rivet snap. There is a slight leakage of air around this ram during the return stroke, but it does not amount to very much and helps to cool off the snaps! It could, of course, be easily eliminated by fitting a leather U collar round the ram at the front end of the cylinder, similar to that used in a hydraulic ram.




Small Pneumatic Gap Riveter.

This riveter is in regular use in one of the largest shops in Canada and was built and installed at an approximate cost of $75.

## SNAP GAUGES.

By Chas. Hattenberger.

THE ordinary type of snap limit-gauge offers no means of taking up wear, since it usually consists of a solid drop forged steel body having certain sized openings at each end marked GO or NOT GO. In course of time, these openings wear large and become useless for accurate work. Herewith are shown a number of different types, all of which may be readjusted to correct size when wear has taken place.

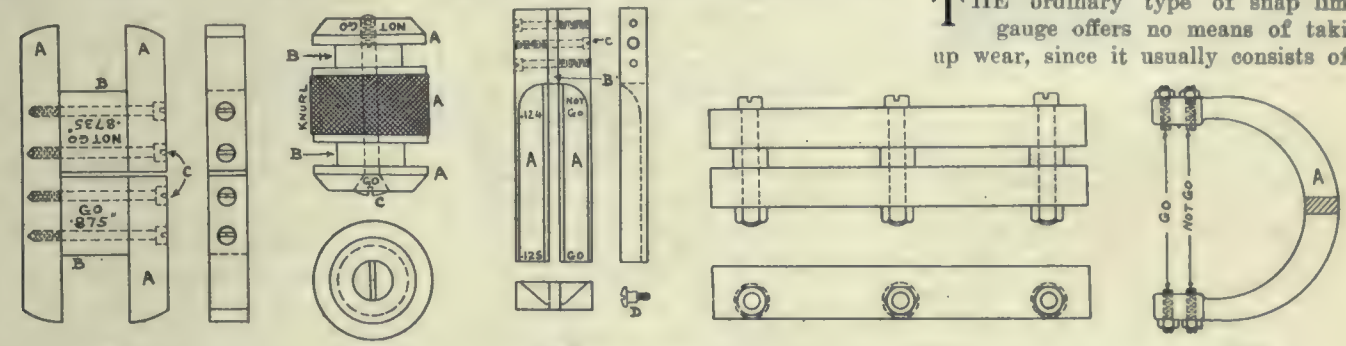



FIG 1 FIG 2 FIG 3 FIG 6 FIG 5

Snap Gauges.

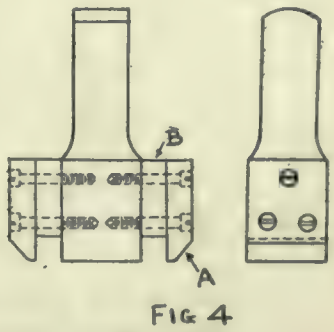



FIG 4

Snap Gauges.

Fig. 1 shows a double ended gauge having jaws, A, of tool steel. These are first milled or planed to size, and then have the screw holes, C, drilled and tapped in them. They are next hardened, after which process it is best to lay them aside for a few weeks, if possible, in order that they may season, and any internal strains be released. They are then ground and lapped straight and affixed to the soft machinery steel size blocks, B, by means of the screws. When wear has taken place it is only

necessary to unscrew the jaws and lap them straight again.

The type of gauge shown in Fig. 2 is very useful for inspecting piston rings.

Fig. 1.—Positive Drive for Miller Arbors.

The jaws, A, are turned up in the lathe, hardened, and then ground and lapped true on their face. The size blocks, B, are of soft machinery steel, while the centre bolt, C, holds all parts together.

Fig. 3 shows a handy type of gauge for inspecting small screws or other articles having a narrow body. (See screw shown at D.) The jaws, A, are made straight and parallel, but the size block, B, is tapered, so that the jaws will be .001 inch wider at the opening than they are at the neck. In order to lighten the gauge the jaws have a bevel milled on them. The screw or other object to be measured is inserted in the opening as far as it will go. If it goes up more than a predetermined distance it is rejected.

The gauge shown in Fig. 4 is constructed on somewhat similar lines to the others shown, but has a handle. The jaws are also wider, being about three times the width of the opening, It forms a convenient gauge for inspecting bar stock, drill rod, etc.

Fig. 5 shows a gauge consisting of a forged yoke, A, and four hardened screws tapped through the ends of the yoke and secured by lock nuts. The outer screws form the GO and the inner screws the NOT GO portion of the gauge. When wear takes place, it is only necessary to screw down on one or other of the screws, first loosening the locknut.

In Fig. 6 is shown a gauging fixture which was used when straightening some small shafts. The latter were 5-16 inch diameter by 5¾ inches long, and were made from 5-16 inch drill rod. After being cut to correct length, they were inserted between the jaws of the gauge. If the shaft did not revolve freely in the opening, which was .3135 inch wide, it was removed and straightened by a raw-hide mallet upon an accurately planed block of cast iron. All parts of this gauge were left soft, except the jaws, which were hardened, ground and lapped on the measuring side.

## POSITIVE DRIVE FOR MILLER ARBORS.

By Donald A. Hampson.

WHEN high speed milling cutters came into general use, the heavier cuts which had to be taken in order that they should prove profitable, found out a weak spot in our millers. Many experienced a lack of power under the new conditions, but in our shop the trouble was a slipping of the arbors in the spindles. Though driven in with a lead maul, and further held by draw-in rods, they persisted in turning under these heavier cuts. To remedy the trouble, I had driving heads turned up from bar steel—one of these being seen in Fig. 1.

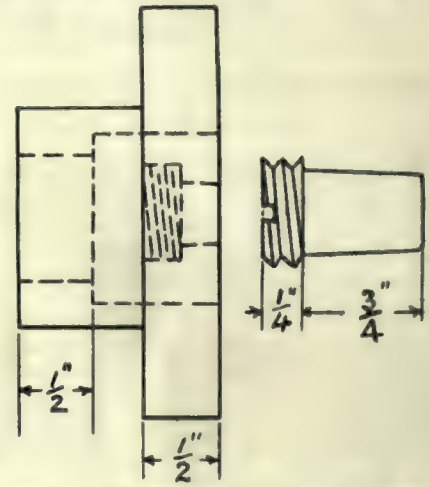


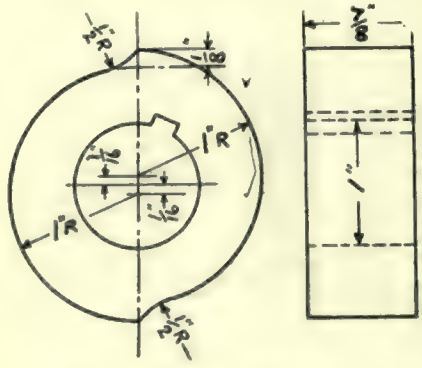

Fig. 2.—Positive Drive for Miller Arbors.

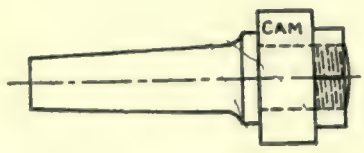
It is threaded to screw upon the nose of the machine spindle and when screwed up quite tight (outside flats for this purpose may be seen), is further locked by two special short, thick screws. The shoulder on every arbor for each machine was flattened on two sides and the driving head for them cut out to fit. Needless to say, no more slipping of arbors was observed after these heads were applied. All later millers of course have such a device as an integral part.

Fig. 2 gives a few dimensions that may be of interest, and also shows one of the screws. It will be noticed that everything is removable, in case some job with limited clearance at that end calls for all the room obtainable. An expenditure for work of this kind is justifiable, not only on account of the direct results obtained, but also from an ethical standpoint, for anything that discourages sledgehammer heroic methods, on fittings that are not to become a permanent assembly, is in line with good practice.

**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**




BLANK CAM ON ARBOR

Making Cams for Relieving Attachment.

## MAKING CAMS FOR RELIEVING ATTACHMENT.

By A. D. Campbell.

ON page 24 of the January issue of Canadian Machinery there was shown an attachment for relieving taps, etc., in a 14-inch lathe, and it is hoped that the following description, of how the cams in such an attachment are made, may prove of interest.

The blank cam is mounted on a suitable arbor and fixed securely in a universal dividing head. The latter is fastened at right angles to the travel of a milling machine table. The indexing arrangement is then set for 250 divisions, because in this particular case the throw

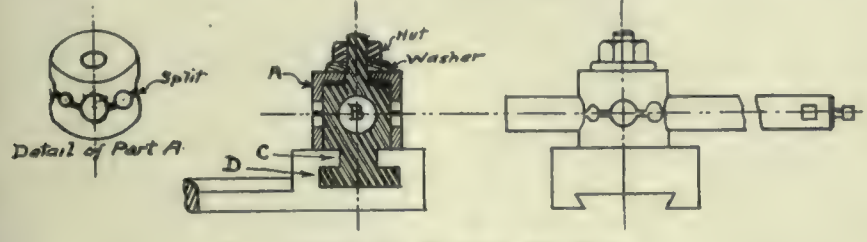
of the cam is ⅛ inch or .125 and there are two lobes. The combined throw is, therefore, .250 inch. The diameter of the cam roller is 1 inch, so we insert a 1 inch spiral end mill in the spindle of the milling machine and all is ready to carry out the job. Touch the cutter on the work and set the graduated collar on the knee elevating screw at the zero mark, Move the dividing-head index pin through one division and raise the knee .001 inch. Then move the index another division and raise knee another .001 inch, and so on until the index pin has moved through 125 divisions, during which time the knee will have been raised .125 inch and the work will have moved through 180 degs. Next, drop the knee back to the zero mark and repeat the operation. If the cam is to be very accurate, a second cut, of about .005 inch, is advisable; it will then be hardly necessary to use a file, as the finish on the job will be quite smooth enough as it comes from the miller.

This method is applicable to a large variety of cams and is much quicker and more accurate than laying them out and filing to lines.

## BORING AND THREADING TOOL POST.

By A. Leonard Marshall.

THE boring and threading tool post shown herewith is made of mild steel and will be found very handy for use on an engine lathe, as it has the advantage of always being ready for any one of four different sizes of bar. The tool post proper has a hole, B, bored through it slightly bigger than the largest bar to be used. The shell A is made a loose fit on this post and is drilled for the four different sizes of bar. It is then cut in two horizontally through the centre of the holes. If the parts marked, C and D, are made circular in section, the boring bar may be set to any angle. By tightening the nut on the top, the whole thing is clamped at one operation.



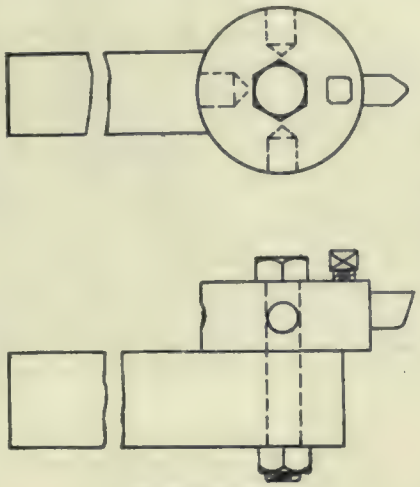

Boring and Threading Tool Post.

Editor's Note.—We publish the above as sent us; but we see no reason why the shell A should not be made in cast iron, as it would be somewhat expensive to make in mild steel.

## A RADIAL PLANER TOOL.

By H. Fozard.

THE accompanying sketch shows a very useful tool for the planer or shaper. It may be used for work requiring long half-round grooves or for forming half bearings for journals in engine beds, etc. By inserting a long bar in the holes around the head, the tool may be gradualy rotated, thus describing an arc. The bolt is adjusted to allow of the tool being moved round with a slight pressure.



A Radial Planer Tool.

## MACHINE TOOL AND ENGINEERING ASSOCIATION.

THE annual general meeting of the Machine Tool and Engineering Association was held at Manchester, England, recently. The chairman, Mr. J. Taylor Peddie, of Messrs. Vickers, in the course of his address urged the importance of organization as a force in the industrial world. An organization was not successfully created that did not have within it departmental organization, or what was known as the unit system, and no organization could be considered to be successfully organized that carried centralization to such an extent as to devitalize the departmental organizations below. It seemed to him that their energies should be concentrated in the direction of improving the efficiency of existing organizations; the association had been formed primarily for this purpose, and the need for it was only too apparent. Present economic conditions necessitated this policy. Rigid economies must be effected in all departments, and this could be done by increasing efficiency through combination or any other method that might present itself to those responsible for the management of industry. He pointed out that as cost of production decreased, wages increased; and it should be borne in mind that costs of production continuously decreased, hence the reason why industry remained active.

Since the statutory meeting of the association in March, 43 additional firms had joined, bringing the total membership up to 80. During the year several members had applied to the association for permission to exhibit at various exhibitions, and permission had been given or refused according to the circumstances of each case. The Home Office had also been in direct communication with the association with respect to the question of adequately guarding gear wheels of machines and had pointed out that foreign machine tool manufacturers supplied their machines adequately guarded, and that the cost of doing so at the time of manufacture was a relatively small item as compared with the subsequent cost of conversion. The Home Office further stated that in many cases British firms had lost orders owing to the want of adequately guarded gear wheels.

With reference to the Machine Tool Exhibition to be held in October at Olympia, the prospects were eminently satisfactory. Of an available space value of $67,500, considerably over $40,000 had already been let definitely. A considerable portion of the remaining space was also at present under option, and this fact strengthened the hands of the Exhibition Committee in entering upon the necessary expenditure to provide adequate publicity so as to ensure a large attendance of those interested in improved methods of production, and also engineering buyers.

## AMERICAN BOILER MANUFACTURERS' CONVENTION, 1912.

The 24th annual convention of the American Boiler Manufacturers' Association, together with its Associate Members and the Supplymen's Association, will be held in New Orleans, La., March 12, 13, 14 and 15, 1912. Some important papers are to be presented, and other business discussed, which will be of interest to all manufacturers and supply houses in the United States and Canada, engaged in the boiler and tank industry. An extensive programme of entertainment has been arranged, and a large attendance is expected.

# Mechanical Drawing and Sketching for Machinists

By B. P.

*A Series of Progressive Lessons Designed to Familiarize Engineers With the Use of the Apparatus Necessary to Make Simple Drawings, to Encourage Them to Realize How Important a Factor it is of Their Equipment, as Well as Being a Profitable Pastime.*

### Small Machine Vise.

THE first example shown this month is a small machine vise suitable for holding work on the table of a drilling machine, planer or shaper. As may be seen in Fig. 1, the casting A has a hole bored in it at one end, in which the swivelling jaw B is fitted, being kept in place by a circular plate and ¾ inch screw. The object of making the jaw to swivel is to enable it to grip non-parallel faces, but this is a feature not often met with, it being more common to make the jaw B solid with the base A and to pack up the non-parellel side of the work with wooden or metal wedges. In the present example it will be noticed that the sliding jaw C, is not solid with the nut, but is attached to the latter by a ½ inch screw having a countersunk head. The shear is taken off the screw by a strip or tongue on the nut which fits into a recess on the jaw. The main screw is 1¼ inch diameter and has 4 threads per inch. It is made left-handed in order that the moving jaw, C, may advance on the work when the screw is turned in the usual right-handed direction, in the same direction as that in which the hands of a clock move. The thrust is taken by a circular nut which bears on the inside of casting A and revolves with the screw. It is threaded on the latter and secured by a taper pin. The head of the screw is enlarged to 2 inches diameter; two ⅞ inch holes being drilled through it at right angles for insertion of a "tommy bar" when closing or opening the jaws. The vise is secured to the machine by ⅞ inch T-headed bolts fixed in the slots of the table and passing through the slots in the base of the vise.

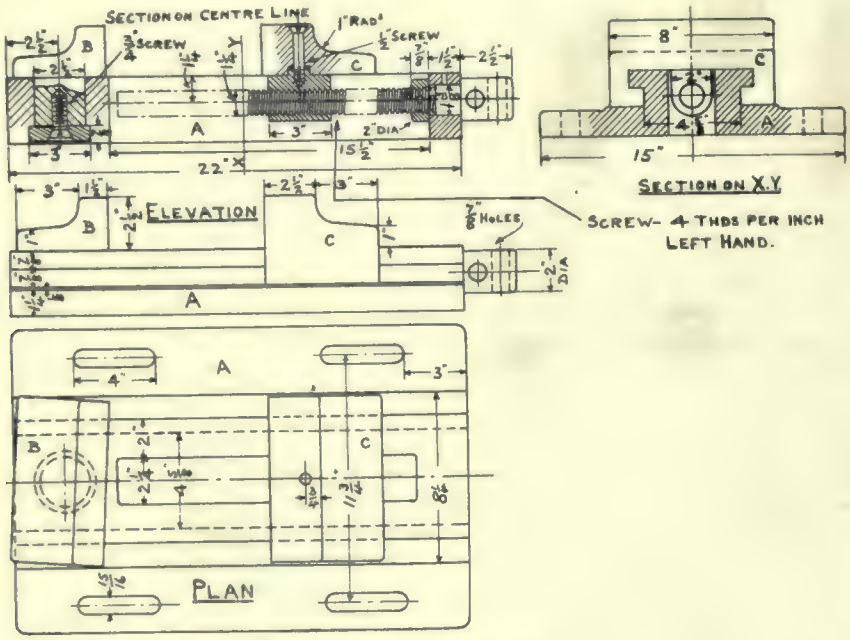



Fig. 1.—Drawing and Sketching.

In the plan view, the jaw B is seen swivelled through a slight angle for the purpose already explained. Each part is similarly lettered in the various views and the student should have no difficulty in finishing the drawing and adding an end view. Several dimensions have been purposely omitted, and the screw is, of course, not shown completely. Draw to a scale of 4 inches to the foot. The jaws, main nut and base are of cast-steel, and the screw of forged steel.

**Exercise.**—Draw each part of the above vise separately to a scale of 6 inches to the foot, with the exception of the base A which may be drawn ¼ size. There are nine parts in all, excluding the taper pin.

### Ratchet Stud Driver.

Fig. 2 shows an all-steel ratchet stud driver, fully assembled. The socket shown is tapped to suit a ⅞ inch stud, several similar sockets accompanying each rachet and each taking a different size of stud. In the upper view the thread appears to extend only half way through the socket; but the object of so drawing it is merely to show the length of the threaded portion of the handle, by means of which the socket is inserted or removed. The 8 teeth in the circumference of the socket are ¼ inch wide and are cut in a milling machine; hence their segmental appearance in section. The radius of the bottom of the tooth is not stated on the drawing, as it is unimportant and depends solely on the diameter of the milling cutter used. The socket is prevented from falling out by the ¼ inch set screw, the point of which engages in a circular groove. This screw should be located ½ inch above the bottom of socket. All other necessary dimensions are clearly shown, with the exception of the size of the coil spring which keeps the pawl in place. This is of steel, and has six coils whose outside diameter is ½ inch and inside diameter 13-32 inch. The head of the pawl is knurled to facilitate drawing back against the pressure of the spring when removing the socket. The handle in the upper view is not shown quite accurately; we leave it to the student's ingenuity to discover what is amiss. Draw to half size and give an end

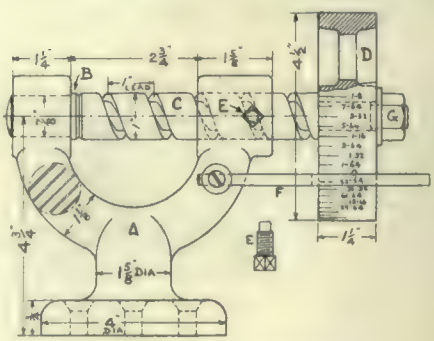


Fig. 3.—Drawing and Sketching.

view, looking at the rachet end.

**Exercise:**—Draw to full size, the socket, pawl and spring, giving all necessary views and dimensions of each.

### Gauging Device.

We now come to Fig. 3 which shows a device for gauging the size of twist drills, reamers or similar tools. As only one view is given and several dimensions are omitted, it will serve admirably to test the progress already made by the student, while at the same time giving him an opportunity to prove his ability as a designer. It will first of all be necessary to get a clear idea of the working and construction of the gauge, for which purpose the following is extracted from a description which appeared in Canadian Machinery of December last:—

"The gauge consists of a cast-iron stand A, having two arms, one of which is drilled 7/8 inch diameter to take the anvil B, which is pressed in. The other arm is not screwed, but is bored out plain to take the measuring screw C, 1 inch diameter. The lead of this screw equals one thread per inch, the groove being 1/4 inch wide and 3-16 inch deep. One end of the screw is turned down to fit the hub of the cast-iron wheel D. The latter has four spokes and is turned to 4 1/2 inches diameter. The circumference is then graduated in the milling machine into sixty-four parts, which are marked from zero to 63-64. A small screw E fits into the groove of the measuring screw and acts as a nut.

Readings are taken by means of the straight edge F, which is made of round cold-rolled stock, and is filed flat for a portion of its length, in order that it may be brought close up against the wheel and clear readings obtained. Its round end is clamped in a boss which projects from the casting A. When the end of the screw C is touching the anvil B, the wheel must be adjusted on its spindle so that the zero mark comes in line with the top of the straight-edge F. It can then be secured permanently in position by the nut G. The face of the anvil and end of the screw should be case-hardened with cyanide, and the base of A drilled for three holding-down screws.

Readings are obtained by inserting the drill, or other tool to be measured, between the end of the screw and the anvil, and reading off the size on the wheel at the straight-edge. If the drill is larger than 1 inch, a number, equal to the number of revolutions of the wheel from zero, must be added to the reading. Thus, in gauging a 1 1/4 inch drill, the wheel will make one complete turn and stop at the 1/4 mark. Similarly for a 2 1/4 inch drill, the wheel will make two and a quarter turns. In practice the toolkeeper does not need to keep track of the number of revolutions. The fractional reading is all he needs, since his eye enables him to tell whether the reading is for a 1/4, 1 1/4 or 2 1/4 drill.

In drawing this gauge, the bosses through which the screw and anvil pass should be made 1 3/4 inches in diameter. The straight edge F is made from 1/4 inch cold rolled steel and should extend 1 3/8 inches beyond the outer edge of the wheel in order that drills up to 2 1/2 inches in diameter may be gauged. The wheel might with advantage be brought somewhat closer in—say 1/2 inch from the boss—when screw is in the position shown. To obtain the graduation marks on the rim of the wheel, an end view of the latter is drawn; the circumference is then divided into 64 parts and by means of the tee square, the points of division are then projected across to the other view. The hub of the wheel is 1 1/4 inch diameter and has a 5/8 inch hole in it. G is a 1/2 inch nut, while the small set screw E is 3/8 inch diameter and is screwed 16 threads per inch. Its point is turned down to 1/4 inch diameter to fit the groove in the screw. It will be remembered that full instructions for correctly drawing such a screw thread were given in our eighth lesson, appearing in September last. Notice in the present case, that though the pitch (or lead) of the screw is 1 inch, the width of the thread and the space are not both 1/2 inch, as is generally the case. Here the width of the thread is 3/4 inch, while the space is only 1/4 inch wide and 3-16 inch deep.

The gauge is fastened to a bench by three countersunk headed screws 3/8 inch diameter. These are equally spaced in a circle, and care must be taken not to locate one of them below one of the arms of casting A, as it would then be impossible to insert the screw, if the latter were reasonably long. The straight edge F is held in a boss cast on A by a clamping screw; the design of this, as of several other points being left to the student's judgment. Draw to a scale of 6 inches to one foot and make a complete drawing, showing three views.

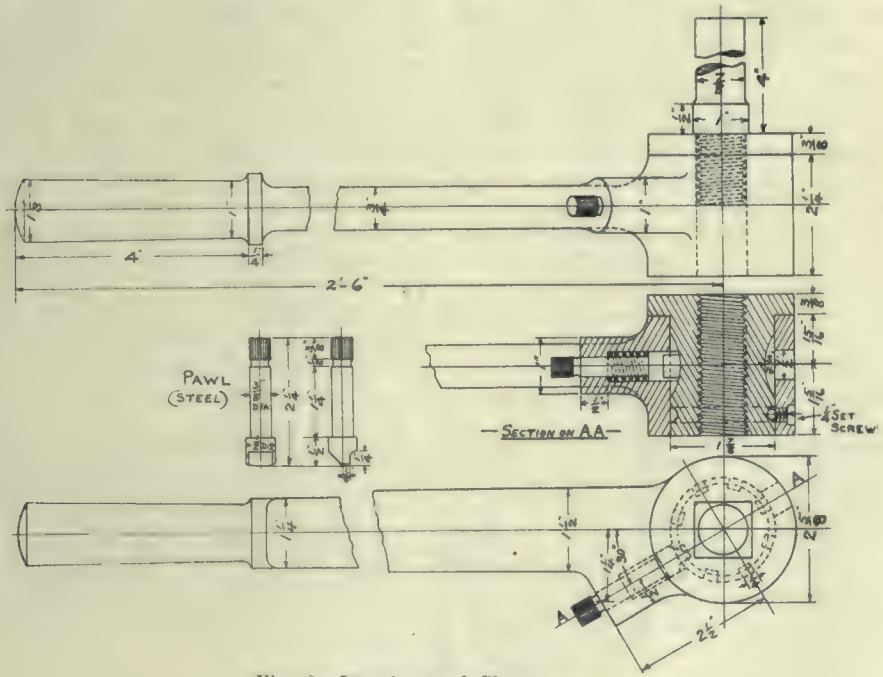



Fig. 2.—Drawing and Sketching.

## Personal

**Mr. Baker**, manager of the **Hamilton Carharrt Co., Toronto branch**, has resigned, and **C. F. Fell**, from the Detroit office has been appointed to succeed him.

• • •

**W. J. Usher** has been appointed manager of the Garlock Packing Co.'s new Winnipeg branch, and associated with him are **B. E. Dalzell** and **E. C. Medland.**

• • •

**Arthur R. Bell** has received the appointment of manager of the Garlock Packing Co.'s new branch at Vancouver, and will have as assistant, **Geo. Cook.**

• • •

**Hugh Jackson**, treasurer of the Positive Clutch & Pulley Co., has resigned his position to become cashier of the Canadian Fairbanks-Morse Co., at Calgary.

• • •

**Mr. J. F. I. Thomas**, who superintended the erection of the Hydro-Electric Plant for the city of Winnipeg, as representative of Vickers, Ltd., is now permanently located in Montreal, where he will look after the electrical end of Vickers, Ltd., business throughout the Dominion of Canada.

# The New Foundry of Beauchemin & Fils, Ltd., Sorel, Que.

By L. G. Dennison, B.A., B.S.C.*

*Steel Castings Now Fill so Large a Place in the Design and Constructional Detail of Mechanical Engineering Products That it is Little Wonder There Should Follow the Establishment and Equipment of Foundries, in Localities More or Less Central, to Accommodate the Prompt Requirements of the Industries Affected. The Plant of Beauchemin & Fils Betokens Not Only a District Demand, But Also a Highly Commendable and Tangible Expression of Enterprise, Worthy of Emulation.*

THE rise and progress of the Canadian steel industry during the immediate past has been nothing short of phenomenal, and although the year 1911 has witnessed a market glutted with American pig and American ore, the steel products of our home manufacturers have been finding an ever increasing market. Evidence of this fact is to be found in the completion of the large steel foundry addition made by Beauchemin & Fils, Ltd., Sorel, Que. This firm, established in 1855, incorporated in 1902, and engaged in manufacturing agricultural machinery, launched into the manufacture of steel castings about two years ago. Their product has commanded such a growing market that new shops capable of a 3½ times increase of output have been found essential. Chrome, manganese, nickel and special carbon-steels are made by the converter process, as also electrical metal, and special attention is given to marine and railroad requirements. A large dredge drum, weighing 8,000 lbs. was made recently. The capacity output is now 25 tons per day, as against 10 tons per day previous to the extensions taking place.

*Associate Editor, Montreal.

### The Buildings.

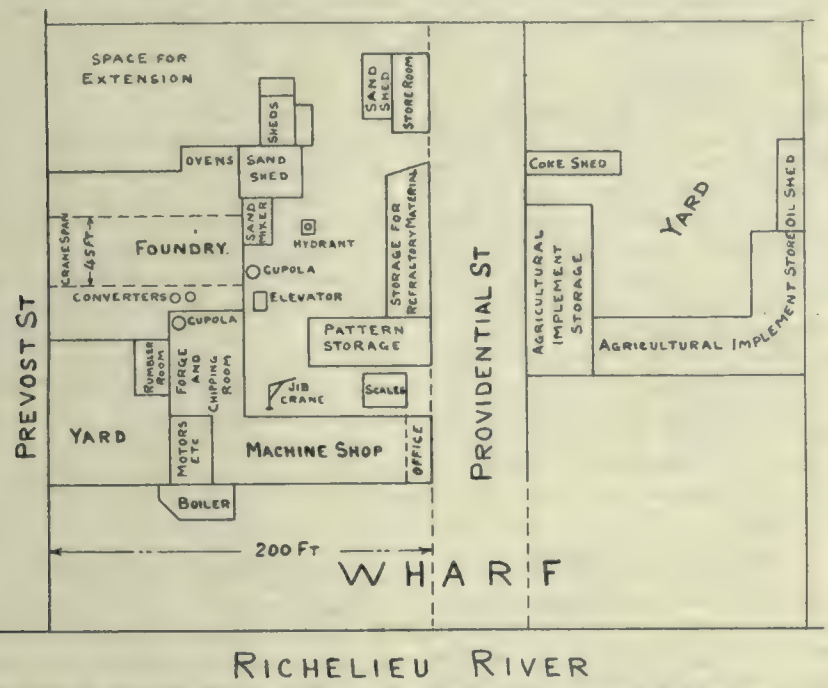
The buildings occupy a ground area of about 112,000 square feet and consist of two blocks, on opposite sides of the street, of sizes 320 x 200 and 320 x 150 feet. Both properties stretch to the river front, thus affording excellent shipping facilities. The foundry extension of steel and concrete gives this section 85 x 100 feet of floor space. The height at the centre is 35 feet and under the wings 22 feet. The roof is of corrugated steel sheets. The machine shop, built of brick and showing the smoke and weather effects of more than half a century, covers an area of 200 x 40 feet. The power equipment, motors and compressers are at one end of the machine shop. The fettling shop is located as shown on ground plan. The foundry and machine shop are both well provided with windows and a well distributed equipment of incandescent lamps furnishes ample artificial light.

### The Foundry.

The main foundry floor is served by a 10-ton Whiting crane of 45 feet span, and equipped with 3 C. G. E. 220-volt A. C. motors of 25, 15 and 7½ h.p. A 10-ton Baillot cupola and a 25-ton Whiting cupola are placed near one end, as indicated by circles. These supply two 2-ton Stoughton converters; the usual arrangement of swinging channels being provided. A motor-driven one ton elevator in the yard runs to the charging floor 25 feet from the ground. The interior cupola, being situated in the wing where the building is low, passes through the roof, and the charging floor, suitably enclosed, is built on top of the latter.

New Foundry and Engineering Works of Beauchemin & Fils, Ltd., Sorel, P. Q.

There are two drying ovens of dimensions 30 x 10 x 8 feet, built in the corner under the wing and heated with coal fires. In connection with these there is installed a rail truck system, arranged for crane loading. An annealing furnace of the usual type, built and installed by the company, and of inside dimensions 10 x 8 x 4 feet, is included in the equipment; also a series of ladles of




Ground Plan of New Foundry and Engineering Works of Beauchemin & Fils, Sorel, P.Q.

capacity from five tons down and a complete modern set of adjustable iron moulding boxes. The foundry gives employment to one hundred men.

**The Machine Shop.**

The machine shop, 110 x 40 feet, has an equipment consisting of lathes, planers, drills, shapers, millers, saws and emery wheels. Forty men are employed in this department. The pattern and wood working shop, employing seven men, is above the machine shop. The tumbler room and chipping or fettling room is located between the two, as shown on the ground plan. A Davis-Bournonville oxy-acetylene welding outfit is installed in the latter.

**Power Equipment and General.**

Power at 220 volts and 25 cycles is obtained from the Sorel Electric Co., and is used also for lighting purposes. The motors are Canadian Westinghouse and Canadian General Electric. A 75 h.p. motor is used for the main drive of the machine shop, and another of equal power drives a Sturtevant blower, which serves the two cupolas. A 50 h.p. motor serves the two converters. The various air operated appliances and tools are served by a Chicago Pneumatic Tool Co., compressor driven by a 25 h.p. motor.

There was a considerable increase of both working and invested capital when operations recently commenced on the larger scale, and the future holds out the brightest prospects. The destinies of the enterprise are under the able direction of the following Board: Alfred Beauchemin, President and General Manager; V. E. Beauchemin, Vice-President; L. Phillipe Tremblay, Secretary-Treasurer, and Alphonse Beauchemin, Director. The works superintendent is J. M. Ryan, of Pittsburg, late with the Montreal Steel Works, the Pittsburg Steel Foundry Co., and the Mesta Machine Co. This foundry is located in an important ship-building centre, and with a wharf and harbor on its own property is in a favorable position for shipping by water route to all the great lake ports, and, therefore, the interior of the Dominion generally.

## HARDENING AND TEMPERING CARBON-STEEL TOOLS.

### II.

By Frank Walker.

THE tool, after undergoing the previously mentioned process, will be found much too hard and, therefore, too brittle for practical use, and must as a consequence be subjected to the heat treatment known as tempering, in order to modify these conditions to suit actual requirements.

**The Process of Tempering.**

Tempering is a partial annealing or softening of the hardened steel, by which means it is possible to restore some of its toughness or ability to withstand shocks and strains, and at the same time retain sufficient hardness to carry a good cutting edge. The process of tempering also relieves to a great extent the internal stresses set up in the steel by hardening. A little thought will show that it is practically impossible to heat or cool a piece of steel uniformly through to its centre, as the outside or skin of the piece will be sensibly hotter than the core when it is removed from the furnace, and will be cooled for an appreciable time before the core when quenching takes place, thereby causing unequal contraction strains which vary in proportion to the size of the piece, the heat at which it is quenched and the temperature of the quenching bath.

The process of tempering is an extremely delicate one. Quenching, as has been explained, "traps" the hardening carbon in combination with the ferrite, and a re-application of heat at a comparatively low temperature will release this hardening carbon and cause the steel to resume its normal or annealed state. In carbon-tool-steels, this change commences when the piece under treatment reaches a temperature of from 390 to 400 degs. Fah., and continues till 700 degs. is reached, at which point the whole carbon-content will have resumed its original form, and the steel its least degree of hardness. In this range of about 300 degs., it is possible, by careful manipulation, to obtain and fix by quenching any degree of hardness required and which the quality of the steel will carry. This degree of hardness can be very accurately determined by the color which the piece assumes as the heat increases.

**Determination of Degree of Hardness.**

When the piece is first withdrawn from the quenching bath its hardened portions will present a silvery grey appearance, and before tempering they must be polished with emery or rubbing stone in order that the changes of color may be seen more distinctly. If the piece be now heated to 420 degs. Fah. a faint tinge of yellow will appear on the polished surface, and which will gradually deepen as the heat is increased; changing to a straw color at 460 degs., brown at 500, purple at 540, blue at at 560, and a very dark blue merging into black at 610 degs. There is as low as is necessary to bring the hardness of any tool for practical purposes. These changes of color are caused by a film of oxide forming on the polished surface, which film thickens with the increasing exposure to the heat.

**Methods of Tempering.**

There are many methods of tempering, each particular class of tool requiring a different treatment. For lathe tools, chisels, etc., the "back-heat" method is the one most generally used by tool-smiths and is a very efficient one when properly carried out. By

this process a tool may be hardened and tempered by once heating. The tool to be treated must be treated in such a manner that only the point or cutting edge reaches the "decalescence" point; the heat graduating back into its other extremity, the heft or tool butt, and not rising above 350 degs. It should then be quenched carefully in the manner before explained, submerging it for about 1½ inches from the point, and holding it in the water till the heat of the unsubmerged portion just above the water line has been reduced by radiation to a dull glow—about 800 degs. Fah. Next remove it from the bath and polish quickly and carefully with a piece of rubbing stone, then, standing close to the quenching bath, hold the tool in such a manner that the light is reflected from this polished surface. In a few moments the temper color will begin to show and gradually extend towards the edge, deepening from behind as it travels. When the cutting edge has assumed the shade which represents the degree of hardness required, dip the tool quickly in the water and quench completely. This is known as "fixing the color."

The foregoing may seem a very simple process, yet nevertheless, it is one which requires great skill and care. The heating, especially, must be very accurately judged so that there is only sufficient back-heat left after the first dip to draw the temper to the required degree, for, if this is not done, great waste of time and material will result. I dare say some of my readers have seen the tool-smith, when tempering, after waiting some little time for the color to run, hold the tool in the flame over the forge:—He has miscalculated his back-heat and has not sufficient to draw the temper on again. They may have had a tool which snapped-off, about an inch or so from the point, at the first cut; in this case, there has been too much back-heat and the steel has been strained when quenching in the final dip. In a tool properly tempered by this method, the hardness should graduate back from the cutting edge, the heft or unforged portion remaining in its original annealed condition.

The back-heat process should be used only with lathe and planer tools, flat drills, chipping chisels, etc.; in the tempering of taps, reamers, twist-drills, etc., different means must be employed. It should be borne in mind that the shanks of such tools as these also require to be tempered, but must be let down to a much lower degree of hardness than the cutting portions, and this can be accurately and safely accomplished by taking advantage of another little-known characteristic of carbon steel.

**Time a Factor in Tempering.**

It has been proved that temperature is not the sole governing factor in tempering, but that time must also be taken into account, and careful experiments have shown that it is possible to obtain a dark blue temper color on a piece of hardened steel either by exposing it to 420 degs. Fah. for 4 minutes or to 600 deg. for 1 minute. As a consequence, if, instead of a fire, we use, for reheating, an oil bath maintained at a constant temperature of 420 degs. Fah.—a good-bodied animal oil is best for this purpose—we can then obtain and fix by quenching in cold water any required temper color, by holding the tool in the heated oil for a longer or shorter period:—For instance, the cutting edges of a tap or reamer may be drawn and fixed at a straw color and the shank afterwards drawn to a blue, by holding it,—the shank,—in the oil for a longer period. If this be carefully done, the two temper colors will be found to merge in the last half-inch from the bottom of the shank.

**Re-Heating by Oilbath.**

The oil-bath for re-heating purposes has many advantages, but perhaps the greatest is the possibility of securing almost absolute uniformity of temperature throughout the whole bath, and if a good lard oil be used, a temperature as high as 520 degs. Fah. may be safely maintained. For tempering threading dies and tools of that shape, polish both sides after hardening, and draw to the temper color by laying them on a flat plate heated to a dull red,—about 1,150 degs. Fah.—turning them over frequently so that both sides attain the same color. Fix by quenching as before.

**General Observations.**

In this article, the writer has endeavored to explain the methods of dealing with the requirements of the small jobbing or general machine shop. For dealing with milling machine cutters, forming and stamping dies and punches, and similar tools, a complete hardening and tempering plant should be installed, forming a separate department, controlled by an expert. In all cases, the tool-smith must be governed by his own judgment with regard to the size, shape and requirements of the tool being treated. Absolute accuracy in the heating is essential, "near enough" methods will not do, for a variation of 20 degrees in the heating of a good brand of carbon-steel will make all the difference between failure and success. These two points must be borne in mind.—Firstly, the tool to be hardened must always be drawn from the furnace on a rising heat and should never be allowed to "soak," that is, be held at a constant temperature for any length of time. In order to insure this, the heat of the furnace or muffle should be kept at least 300 degs. above the "decalescence" point of the steel being treated. Secondly, the tool after forging should be allowed to cool down to about 180 or 200 degs. in a warm, dry place before it is heated up for hardening.

In conclusion, a few remarks on forging may not be out of place. Heat in a clean, bright fire of generous dimensions,—charcoal does best for the former,—and use just sufficient blast to keep the fire brisk. Forge at as low a heat as the steel will take to kindly. Work the piece from back to edge, uniformly, and remember that continued hammering, at very low heats, improves the quality of sound carbon-steel. Lastly, never allow the heat to "soak," for "soaking" is as detrimental to good forging as it is to good hardening.

## INDUSTRIAL ACCIDENTS.

There were 82 fatal and 194 non-fatal accidents to work people recorded by the Department of Labor during December, 1911. This shows a slight decrease compared with the preceding month, and is much less than in the corresponding month last year. In November there were 286 accidents, fatal and non-fatal, to individual workmen, and in December, 1910, there were 351 accidents. The chief disasters during the month were the suffocating of three miners at Middlesboro, B.C., in a chute of a mine, and an explosion at a powder factory in Departure Bay, Vancouver, B. C., in which three men were killed. There were eleven killed in the railway service, and fourteen in mining. The largest number of non-fatal accidents occurred in the metal trades, in which forty-two were injured. Nine men were killed and thirty-one were injured in the building trades, an unusually high number for the month of December. There were twenty-six non-fatal accidents in the railway service.

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Electro galvanizing has proved to be a very satisfactory protection to iron and steel from rust. It has not been found a competitor of hot-galvanizing to any extent, but has replaced other metal coatings such as nickel and copper. As a protection against rust, however, it has been found far superior to these metals.

## ELECTRICITY FOR ROLLING MILLS*

By C. Antony Ablett.

IN introducing the subject, the author observed that the power required to drive a rolling mill generally varied rapidly between wide limits, while in order that power should be generated cheaply, the demand made on the generating plant should be maintained steadily at the full capacity of that plant. To ensure that the working costs of a rolling mill should be low, means must be found for reducing the fluctuations in the power required to drive the mill, care being taken in doing this, that the capital cost of the plant was not unduly increased, nor was the possible output reduced. Any reduction of the possible output was equivalent to an increase in the working cost, as the capital charges per ton were increased.

### Variation of Power Feature.

The variations in power were reduced by employing a flywheel in conjunction with the electric motor used to drive the rolling mill, and by providing some device for reducing the speed of the motor and flywheel, so as to enable the flywheel to give out some of its stored energy when the demand for power was great, thus reducing the amount of power which had to be furnished by the motor. When the demand was small, the motor would speed up the flywheel, thereby replacing its stored energy ; this increased the power which the motor had to supply when the demand made by the mill was small, and therefore reduced the total variation in power.

Apart from large reversing rolling mills, the largest variations in power occurred in tinplate and sheet mills. With merchant mills and bar mills, the variations in power were less, while in the ordinary looping mill for rolling wire rod, where the rod might be in six pairs of rolls at once, and where a fresh rod was entered while the previous one was still in the rolls, the power required to drive the mill did not vary much. A special case was that of a tire mill, where the variations in power were considerable, but where the power demand remained pretty steady for nearly a minute, so that a flywheel would not prove of much benefit in reducing the fluctuations in power unless it were very heavy indeed.

The stored energy of the flywheel varied as the square of the speed at which it was running, so that if a flywheel were used in conjunction with this motor it would only give up 4 per cent. of its stored energy as the power increased from light load to the full power of the motor. The rolling mill might require during a pass, a power equivalent to four times the normal full-load power of the motor for a few seconds; commercial motors would not give more than twice the normal full-load power for a few seconds without being liable to injury, and to prevent this, the circuit breaker was usually set to open at the current corresponding to that power. The flywheel, therefore, had to furnish the power which was in excess of that which the motor could give. In the case considered, the motor would fall perhaps 5 or 6 per cent. in speed when the power increased from light load to double full-load power, so that the flywheel would give up only 10 or 12 per cent. of its stored energy. The flywheel, therefore, would have to be abnormally heavy, or else if a flywheel of a weight within the bounds of commercial possibility were adopted, the combination would be unable to cope with this demand for power, and the motor power would increase until the circuit breaker opened. It was, therefore necessary artificially to increase the fall in speed of the motor as the power which it had to give increased. If the speed fell by, say, 10 per cent. as the power increased from zero to full load, and, say, by 22 per cent. as the power increased to the double full-load power, the flywheel would have given up 39 per cent. of the stored energy by the time that the motor was giving double its normal full-load power, instead of from 10 to 12 per cent. A flywheel, therefore, of moderate weight, would materially assist the motor in overcoming heavy demands for power which lasted for a short time only.

In practice, the maximum power given by the motor would seldom be so much as double the normal power, nor would the motor power sink to zero, as even when nothing was being rolled, the motor would still have to provide the power for overcoming the friction of the mill, which was considerable. There were two devices for artificially increasing the fall in speed of the motor as the power demand increased. These were commonly spoken of as (1) the permanent-slip regulator, and (2) the automatic-slip regulator; but it would be more correct to call them (1) the continuous-slip regulator and (2) the intermittent slip-regulator.

### The Continuous-slip Regulator.

In the case of the direct-current motor the continuous-slip regulator consisted of an ordinary compound winding provided for the field-poles, while the intermittent-slip regulator consisted of a system of relays which successively short-circuited resistances in series with the shunt field winding, thus increasing the field and causing the speed to fall when the power had reached a certain predetermined point. In the case of the three-phase motor, the continuous-slip regulator consisted of a resistance, liquid or metallic, permanently inserted in the rotor circuit, while the intermittent-slip regulator might be either a liquid resistance, the moving plates of which are controlled by a motor relay, so that the plates were raised and the rotor resistance increased when the current had reached a predetermined point, or a metallic resistance which had its various sections short-circuited by a series of relays so arranged that the relays cut the resistance into the rotor circuit when the current had reached the predetermined limit.

For the sake of simplicity it was assumed that the fall in speed of the motor or slip below no-load speed was proportional to the power which the motor was giving. Within the limits of fall in speed or slip of the motor, it could be assumed that the stored energy given up by the flywheel was proportional to the slip, without involving any large error, therefore, the power given by the flywheel was proportional to the rate of change of the slip or to the rate of change of the motor power. Thus, if a sudden increase of load was imposed on the motor and flywheel by placing a bar between the rolls, and a curve was constructed showing the increase of motor power with the time, this curve would be a logarithm curve; while if the power required by the mill suddenly decreased owing to the bar leaving the rolls, the motor power decreased also, according to a logarithm curve. The curves showing the rise and fall in speed of the motor and flywheel were also corresponding logarithm curves. After the bar left the rolls, the power which the motor gave, while decreasing to the value corresponding to the friction, went to increase the speed of the flywheel, and so replaced its stored energy. These curves were quite analogous to those for the heating and cooling of electrical machinery, the power of the motor, however, rose to practically its full value in a few seconds, while the temperature of an electrical machine took a number of hours to reach approximately its full value.

### Intermittent-slip Regulator.

One type of intermittent-slip regulator suitable for direct-current motors consisted of a small motor relay to set in operation a number of relays which successively connected resistances in parallel with the resistance placed in series with the shunt field of the motor. The field of the motor relays was excited by the main current passing through the mill motor armature. If the mill motor was small the main current passed through this field, but if the main current was too big, the field was placed across a shunt in the mill motor circuit.

*Abstract of paper read before the Institution of Electrical Engineers, London, Eng.

The action of the intermittent-slip regulator was very different from that of the continuous-slip regulator. It came into action when the power given by the motor attained a certain value, and when this point was reached a very slight increase in power indeed would cause the intermittent-slip regulator to act to its fullest extent.

Theoretically speaking, therefore, the power could be maintained at its average value with a deviation of perhaps less than 1 per cent., so that the power curve was practically a straight line, and did not rise and fall in accordance with logarithm curves, as was the case with the continuous-slip regulator. Assuming that constant power was required throughout the pass when a bar was between the rolls, and as the power given by the motor was practically constant, the power given by the flywheel would also be practically constant, or in each small interval of time, the same amount of stored energy was to be given out by the flywheel. The speed would, therefore, fall during the pass in accordance with the straight-line law, and would rise again in the interval between passes, also in accordance with the straight-line law, and there would be no logarithm curves for the rise and fall in speed as with the continuous-slip regulator.

The author also discussed the arrangement of motor and flywheel to suit power supply, the Ilgner system of driving three-phase current for merchant mill driving and friction losses.

**Economy.**

Various economies could be effected by electrical driving when properly applied, but one of the principal economies was that of the cost of power. The electrical drive often enabled cheap power to be used when it could not be transmitted or applied in any other way, and also in many cases it afforded a means of enabling power to be generated cheaply, so that in planning an electrical drive every care should be taken to make use of its natural advantages as far as possible.

In a large city where land was expensive, and where facilities for generating power in each individual works were far from the best, it was generally found to be most economical to buy power from the supply authority where the amount required was not very large, because power could be generated in bulk in a power station and distributed to the various works more cheaply than the works could generate it themselves. Where works were not situated in a city, and where the cost of ground, etc., was much less, it was generally found that the works themselves could generate more economically unless the amount of power required was very small. Where cheap power was available, it must be applied as economically as possible and it would be seen from what had been said in the foregoing, that considerable care must be exercised in applying a motor and flywheel to a rolling mill in order to ensure that the power was utilized as cheaply as possible if it was desired to obtain economy in working.

## OPENING ANNOUNCEMENT.

The Canadian Cleveland Drill Co., have established themselves at 24 Adelaide Street, West, Toronto, where in addition to the headquarters office, a warehouse for the purpose of carrying a large and complete line of "Cleveland" pneumatic tools, and a fully equipped machine shop to take care of repair requirements, are also located. Exclusive "Cleveland" selling rights for Canada have been secured, and, therefore, everything, including correspondence, pertaining to Canadian business will be handled at the above address. The new enterprise will materially tend to improved service and prompt delivery, obviating, as it will, the harassing delays inseparable from the customs regulations. At a later date, a full line of "Cleveland" rock drills and air compressors will also be carried in stock. Mr. H. C. White is manager of the new undertaking, and needless to say is brimful of enthusiasm for his work. Numerous inquiries and orders have already been received for pneumatic equipment.

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Toronto, Ont.**—Fire did $300 damage to the Valleyfield Iron Works here on Peter street.

**Toronto, Ont.**—McGregor & McIntyre, Pearl street, are contemplating the erection of a foundry on Pearl street to cost $30,000. New machinery will be installed.

**Hull, Que.**,—Fire did $2,000 damage to the plant of the Walter's Axe Company recently.

**London, Ont.**—Assembling shop, threshing machines of Geo. White & Sons, Co., Cabell avenue, London, were damaged by fire to the extent of about $25,000. Tools and stock destroyed will be replaced at once.

**Gananoque, Ont.**—Mr. Ketchem reported receipt of a letter from an English manufacturer regarding the establishment here of a malleable iron works, and asking what advantages the town could offer.

**Brandon, Man.**—The Brandon Construction Co. plan to convert their shop into a woodworking factory. Work on alterations will start at once, and new machinery will be installed.

**St. Boniface, Man.**—Fire completely destroyed the plant of the Winnipeg Steel Granary and Culvert Co. recently. The loss is placed at $15,000.

**Brantford, Ont.**—The Cockshutt Plow Co. has acquired the Adams Wagon and Brantford Carriage Co., and large additions will likely be made by the new owners.

**Edmonton, Alta.**—The Van Slyke Plow Co. have been incorporated and will locate here. They will manufacture plows, farming implements, etc.

**Welland, Ont.**—Welland's latest industry is a nut and bolt works, which has secured a site in Industrial Park. A plant will be erected at an estimated cost of $50,000.

**Lunenburg, N.S.**—The annual meeting of the Lunenburg Foundry Co. was held last month. Steps are being taken to augment the plant.

**Ottawa, Ont.**—Incorporation has been granted to the Algoma Steel Bridge Co. of Winnipeg, capitalized at $40,000. The promoters are A. Y. Bayne, M. McCollum, A. A. Gould, W. S. Thomas, all of Winnipeg, and M. B. Stone, of Minneapolis.

**Fredericton, N. B.**—The city council will press its case at Ottawa in the endeavor to secure the location of the St. John and Quebec Railway car shops here.

**Port Arthur, Ont.**—The Industrial Commissioner is endeavoring to secure the western branch of the Canada Car Company for this city.

**Montreal, Que.**—The G.T.R. recently placed orders for over four thousand cars of various kinds. These include 44 passenger coaches, 23 baggage cars, 300 box cars, and 1,000 coal cars.

**Kingston, Ont.**—At a meeting of the North American Smelting Co. held here early last month, the directors voted to rush the installation of the furnaces and power plant at the smelter. The company expect to begin operations by May 1st.

**Vancouver, B. C.**—The Granby Consolidated Mining and Smelting Co. will erect a smelter at Goose Bay, in the Portland Canal district early this spring. The proposition will entail an expenditure of $1,000,000.

**Toronto, Ont.**—The Wolsley Tool and Motor Co. are erecting a garage at 81 Avenue Road. This marks the coming of the first automobile manufacturer to Canada, and if business warrants it, the syndicate will invest heavily in a motor factory.

**Belleville, Ont.**—Marsh & Henthorn, foundry and machinists, contemplate the erection of new foundry and machine shops. President and manager, L. W. Marsh, Belleville. The company are waiting until the C. P. R. is located. New buildings will probably cover two acres.

**Port Colborne, Ont.**—That the Buffalo Union Furnace Co. will erect a plant here is now assured, since the Dominion government has granted the concessions asked for. The Port is now counting on the establishment of several other industrial concerns.

**Kerrobert, Sask.**—N. T. Elliott has established a machine shop here. He has erected a suitable building and completed the installation of a lathe and complete blacksmith's outfit. He contemplates adding an iron planer, trip hammer, and screw machine.

**Tilbury, Ont.**—Temporary quarters have been secured for the Canadian Top Co. New machinery will be purchased. Plans for a new factory will be prepared later. It is rumored that the factory may move to Chatham. Machinery loss in recent fire was $12,000.

**Port Arthur, Ont.**—Acting for Mackenzie & Mann and an English syndicate, J. M. Fraser, manager of the Atikokan Iron Co., has submitted to the city application for a $5,000,000 plant here. The city will be asked for certain concessions, one of which is for a 400-acre site at Bare Point.

**Bridgeburg, Ont.**—Plans are being prepared for foundry warehouse, shops, offices, etc., for the Tuttle-Bailey Manufacturing Co., Cleveland, manufacturers of Ferro-Steel Heating Registers. Supt. Peter Gordon, Jarvis street, Bridgeburg. Foundry, warehouse, Japan ovens, office and machine shop equipment will be required.

**Kindersley, Sask.**—A large machine shop, foundry and garage is being established in Kindersley by Messrs. Hay, Pine & Co., formerly of Kingston, and themselves practical machinists. They are quite optimistic over the opportunity they believe exists in their line. A seventh lumber yard is also being established by J. H. Hahn, a local man, who believes the prospects for the coming year warrant the undertaking.

**Hamilton, Ont.**—A site has been secured for a machine plant, cost $200,000, on Sherman avenue, for Brown, Boggs & Co., machinists, Victoria ave. and King William street. President, J. M. Brown. Manager, W. E. Blanford. The company, in proposed new plant, will specialize in manufacture of tools and machinery, and the purchase of a large amount of machinery is involved in contemplated expansion.

### MUNICIPAL.

**Dunnville, Ont.**—The ratepayers carried the by-law to raise $24,000 for waterworks improvements.

**Vernon, B. C.**—A by-law to borrow $12,000 for sewerage extension purposes was passed by the council.

**Owen Sound, Ont.**—The ratepayers passed the hydro-electric and gas extension by-laws.

**Berlin, Ont.**—The ratepayers carried the following by-laws:—Waterworks extension, $100,000; drainage improvements, $10,735; extending street railway, $7,400; and trunk sewer, $1,700.

**Ingersoll, Ont.**—The ratepayers passed the $125,000 waterworks by-law.

**Barrie, Ont.**—The ratepayers passed the by-law to raise $35,000 for sewers.

**Carleton Place, Ont.**—The ratepayers passed the by-law to spend $100,000 on a waterworks system.

**Hamilton, Ont.**—The following by-laws were passed by the voters:—Waterworks extension, $650,000; Gore Park public convenience, $14,000.

**Selkirk, Man.**—Two by-laws were passed by the ratepayers recently:—One confirming the agreement between the town and the W. S. and L. W. Railway regarding electric power; and the other to raise $25,000 to establish a municipal lighting system.

**Renfrew, Ont.**—The by-law to spend $60,000 for additional improvements to the power plant carried.

**Cornwall, Ont.**—The ratepayers expressed themselves as favorable to municipal owner-


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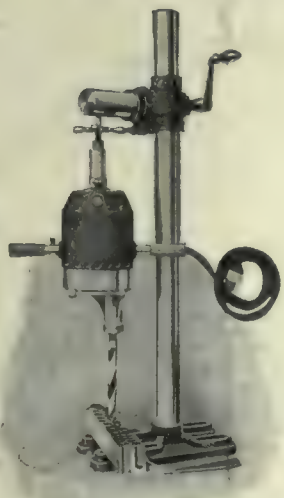

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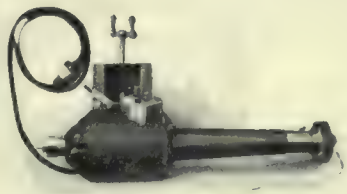

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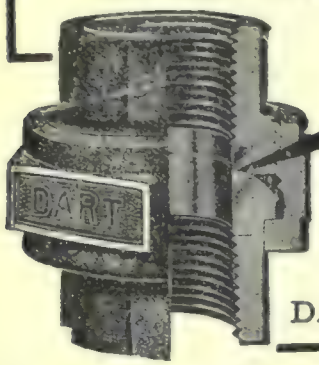


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ship of electric light and gas, but were opposed to buying the present plants.

**Woodstock, Ont.**—The ratepayers passed the electric light by-law recently.

**Killarney, Man.**—The by-law to raise $14,000 to purchase the electric light plant was defeated.

**Vancouver, B. C.**—The B. C. Electric Railway Co. will spend over a $1,000,000 during the coming year. This will double the output of the electric power plant.

**Toronto, Ont.**—The ratepayers carried the by-law to raise $2,200,000 for hydro-electric extension.

**Brampton, Ont.**—The by-law to purchase the Brampton Electric Light Franchise was carried by the ratepayers.

### BUILDING NOTES.

**Ottawa, Ont.**—The Public School Board contemplate an expenditure of $80,000 for an addition to Kent street technical school.

**St. John, N. B.**—F. R. Dearborn contemplates the erection of a six-storey building on Water street. He also contemplates converting his building on Prince William street into an up-to-date office building. A passenger elevator will be installed; also a series of fire-proof vaults.

**Toronto, Ont.**—A. B. Coleman is about to erect a $1,000,000 apartment house on the north side of the Rosedale ravine.

**Vancouver, B. C.**—Messrs. Parr and Fee, architects, have prepared plans for a six-storey building here for John Lewerke.

**Guelph, Ont.**—The Masons of this city will erect a three-storey building. A passenger elevator will be installed.

**Calgary, Alta.**—The Alberta Commercial Travellers' Association will erect a $100,000 building here. It will contain club rooms, stores, and offices.

**Edmonton, Alta.**—J. H. Picard has secured plans for an eight-storey business block here. Construction will not be undertaken until the spring of 1913.

**Edmonton, Alta.** Armstrong Bros. are preparing to erect an $85,000 building here in the near future. It will be of brick and steel construction.

**Toronto, Ont.**—P. J. Mulqueen has obtained a permit for a five-storey hotel here on the east side of Yonge street, to cost $80,000.

**Brantford, Ont.**—The Dominion government will erect a $2,000,000 post office building here. They have secured a $40,000 site.

### PLANING AND SAW MILLS.

**Montreal, Que.**—The sash and door factory of Joseph St. Louis on Simard avenue, was destroyed by fire recently.

**Milverton, Ont.**—The C. B. Honderich Co. which conducts a planing mill here contemplates going into the manufacture of furniture and will probably erect a new plant here.

**St. Mary's, Ont.**—The planing mill owned by George Brown & Company, was gutted by fire recently. The machinery and contents were entirely destroyed and the walls of the building damaged. The damage is estimated at between $8,000 and $10,000, partly covered by insurance.

**Calgary, Alta.**—The Dominion Saw Mills and Lumber Co., the large English corporation which within the last year or so has acquired extensive lumber milling interests in British Columbia, has decided to locate its chief office for the manufacturing end of the business in the city of Calgary.

**Lethbridge, Alta.**—A. G. McLaren has made a proposal to the city to erect a huge sawmill plant at a cost of two and a half million dollars in return for certain concessions. The industrial committee has the proposal under consideration.

**St. Mary's, Ont.** — The St. Mary's Wood Specialty Co. suffered to the extent of about $20,000 by fire, from a cause unknown. There is insurance of $17,000.

### GENERAL MANUFACTURING.

**Calgary, Alta.**—The Canada Malting Co. will erect an extensive plant here to cost $250,000. It is expected that a by-law will be submitted to give the company a fixed taxation for a period of years.

**New Westminster, B. C.** — The Portland Cement Construction Co. are planning to erect a plant at Tod's Inlet. It will be equipped in the most modern fashion, and will cost approximately $1,000,000.

**Port Arthur, Ont.**—The Twin City Bedding Co. are taking steps to enlarge their present factory.

**London, Ont.**—A number of local men are behind a company which will start a new box factory here. They will manufacture cigar boxes exclusively.

**Winnipeg, Man.**—It has been announced that the Quaker Oats Co. of Peterboro' will erect a large cereal plant and flour mill here in the spring.

**Vancouver, B. C.**—The factory and woodworking plant of the Terminal Construction and Manufacturing Co., West Fairview, was destroyed by fire recently. The loss, $25,000, is partially covered by insurance.

# REPUTATION COUNTS

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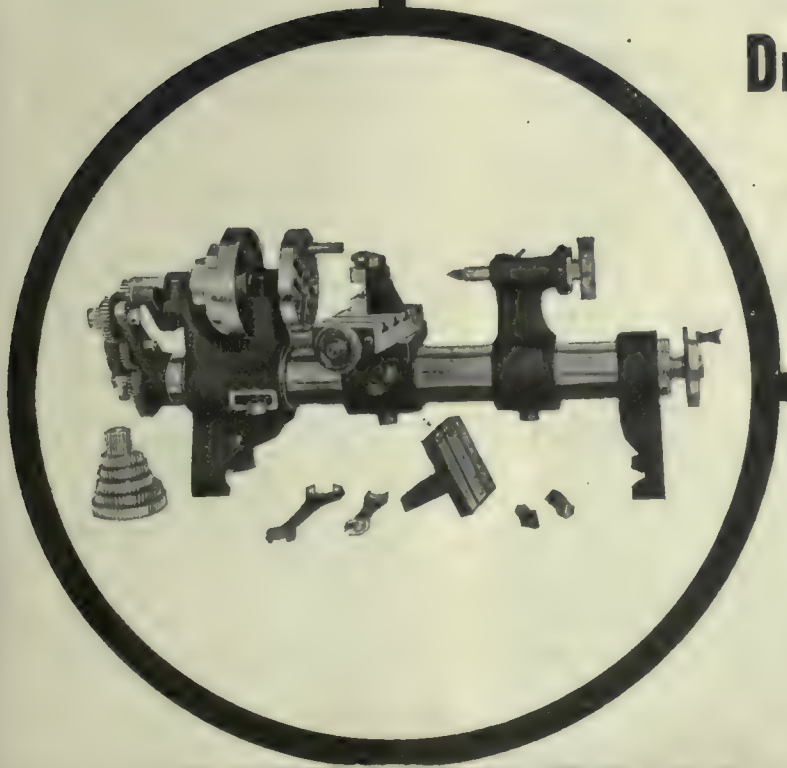

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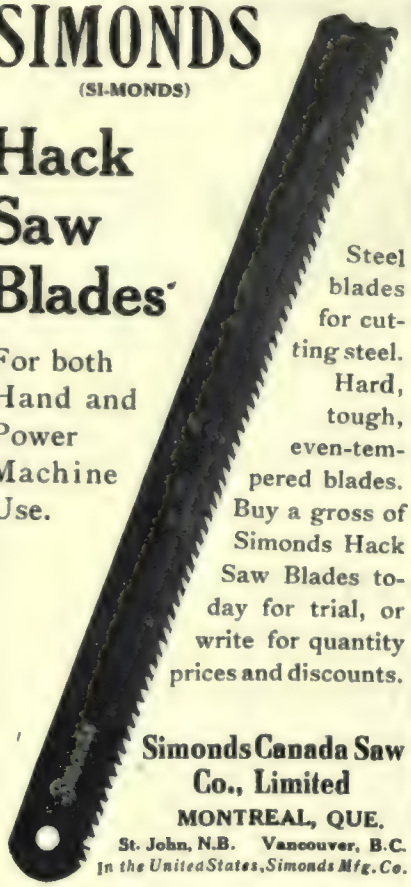
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**Montreal, Que.**—Fire did $25,000 damage to the Dominion Button Co. here some time ago.

**Sarnia, Ont.**—The Ontario canners are planning to instal additional machinery and otherwise augment their plant in the near future.

**Kincardine, Ont.**—Mr. Coombe has bought out the Coombe & Watson Chair Factory here. He may possibly start another factory here to manufacture a different line of goods.

**Bracebridge, Ont.**—The Bird Woollen Mills Co. will erect a three-storey re-inforced concrete building here, 30 x 100 feet. They were voted certain concessions by the ratepayers.

**Fort Erie, Ont.**—Chas. Landon has established an electrical novelty factory here. He has installed a quantity of modern machinery.

**Owen Sound, Ont.**—J. H. Cole has about completed arrangements to establish a bolt and nut factory here. The ratepayers have voted to grant him assistance.

**Rosthern, Sask.**—The Union Supply Co. will erect a big flour mill here to replace the one recently destroyed by fire.

**Blairmore, Alta.**—A number of eastern capitalists have purchased a site here and will erect a $75,000 plant to manufacture fire brick.

**Winnipeg, Man.**—The Canadian Enamel Concrete Brick and Tile Co. will establish a plant here to manufacture a new kind of concrete brick. $150,000 worth of machinery will be bought.

**Medicine Hat, Alta.**—The Steam Laundry Co. are preparing to erect a two-storey brick building here. They will spend $25,000.

### ELECTRICAL.

**Ottawa, Ont.**—Ottawa Electric Railway Co. contemplate purchase of oil engines or large steam engine to produce between three and four thousand horse power as an auxiliary plant.

### GENERAL MANUFACTURING.

**Bassano, Alta.**—A site has been purchased for cold storage plant for Calgary Brewing and Malting Co., Calgary. Erection of plant will commence early in the spring.

**Bancroft, Ont.**—S. Plows' grist mill, E. Reid and Sons' woollen mill, J. D. Payne's machine shop, and the electric light plant were destroyed by fire on January 25.

**Sault Ste. Marie, Ont.**—Negotiations are in progress for extension to paper mills of Lake Superior Paper Co. It is thought that the concessions the town is willing to grant to company will be considered satisfactory by directors in England whom Mr. Talbot will interview this month. Plans entail expenditure of $1,000,000.

**Fonthill, Ont.**—Plans are being prepared for canning factory for Dominion Canners, Ltd., Hamilton. Plans to be ready in about three weeks, when contracts will be called.

**Frank, Alta.**—Keystone Portland Cement Co. are contemplating the erection of a new cement plant. Vice-president, E. A. Cunningham, Lethbridge; director, P. Lund, Wardner, B. C. Building will probably commence at once.

**Strathroy, Ont.** — Strathroy Canning Co. (Dominion Canners, Ltd.) Hamilton, plan to erect a two-storey extension to canning factory. It is stated that plans are being prepared and that additional equipment will be purchased. Cost $10,000.

### TRADE GOSSIP.

**The Corbet Foundry and Machine Co., Ltd., Owen Sound, Ont.,** report having had a first rate year in 1911. Prospects for 1912 are very bright, there being a large amount of work in hand and in view. Last summer the firm built five steel bridges, as well as a large amount of marine and structural steel work.

**The Wm. Kennedy and Sons, Ltd., Owen Sound, Ont.,** have on hand a contract for seven cement pulverizers for The Canada Cement Co., Montreal, together with a great deal of other work. Their machine shop is now working night and day. The steel foundry is also fully employed. In the coming spring it is intended to largely increase the facilities for handling work now existing in the steel foundry, with a view to increased output.

**Heenan & Froude, Manchester, England,** have been awarded a silver medal by the Royal Sanitary Institute for their "Trough Grate for Refuse Destructors." Before deciding the award, two experienced judges went to Hertford to see the grate and clinkering apparatus in operation. Laurie & Lamb, Board of Trade Building, Montreal, are the Canadian representatives.

**H. W. Ward & Co., Machine Tool Builders, Birmingham, England,** inform us that they have made arrangements with the purchaser of the freehold of the Lorraine-Dietrich Works, Bournbrook, for their occupation, to relieve the congested state of their present works, and afford greater facilities for the manufacture of their products. They are installing new machinery, and intend commencing operations immediately at the beginning of the New Year.

**Mussens, Limited,** dealers in railway, contractors, mining and municipal machinery and supplies, have sent us an office calendar for 1912. A number of the principal lines handled by the company are displayed on the various sheets of the calendar.

### TENDERS AND CONTRACTS.

**Victoria, B.C.**—The city council on the recommendation of the water commissioner decided to purchase 10,000 feet of ten-inch pipe, 10,000 feet of eight-inch pipe, 50,000 feet of six-inch pipe, and 50,000 feet of four-inch pipe at a cost of $55,000. In addition, there will be purchased 1,220 water meters of the Trident type at a cost of $17,670.

**Winnipeg, Man.**—Tenders for the supply and installation of a five million gallon horizontal turbine pump driven by an induction motor, direct-connected, will be received until March 1st, 1912.

**Hamilton, Ont.**—The Hamilton Bridge Company has secured the contract for the erection of the new buildings for the Steel Company of Canada. Total cost, $140,000.

**Lethbridge, Alta.**—The contract for street car equipment has been awarded to United States Steel Products Co., 706 McArthur Bldg., Winnipeg.

**THE DOMINION STEEL CORPORATION.** At a meeting held Jan. 16, the stockholders of the Dominion Steel Corporation voted in favor of issuing $7,000,000 of the $17,000,000 authorized 6 per cent. preferred stock, to be exchanged for the 6 per cent. income bonds of subsidiary companies. The program of improvements and extensions now under way or planned for the immediate future includes 10 new collieries, to be operated by the Dominion Coal Co., and two blast furnaces, new coke ovens and additional machinery, to be installed at the steel plant.

### CATALOGUES RECEIVED.

**The National Machinery Co., Tiffin, Ohio,** have again issued a catalogue of their well-known bolt and rivet headers and forging and upsetting machines. These are now too well known to call for extended comment. The catalogue is expensively gotten up and is a fine example of the printer's art. Those desiring a copy should ask for catalogue E.

**The Independent Pneumatic Tool Co., Chicago, Ill.,** have sent us a copy of their circular O, descriptive of the various **Thor** pneumatic tools which they manufacture. These include riveting and chipping hammers, piston air drills, grinding machines, close quarter piston air drills, pneumatic stay-bolt drivers, etc. The company will be glad to demonstrate the merits of their tools to any responsible concern by a thirty days' trial.

**The National Tube Co., Pittsburgh, Pa.,** have favored us with a copy of their Bulletin No. 7, dealing with the Regrinding Valves made by them. The regrinding of one of these valves does not necessitate its removal from the pipe line, nor the use of a regrinding machine. This feature is attained by a novel method of uniting the body of the valve with the bonnet, which it would be difficult to make clear without an illustration. The bulletin, however, explains this and other features, and will be mailed to parties who are interested.

**The Reliance Electric and Engineering Co., Cleveland, Ohio,** have issued Bulletin No. 7010, setting forth the merits of their Automatic Starting Control for motor-driven machinery, introduced to prevent injury to motors at starting, due to the hastiness or inexperience of the operator. The bulletin is illustrated by numerous photographs of motor-driven machine tools fitted with this device.

**The General Fire Extinguisher Co., New York,** have mailed us their January Bulletin, dealing with the Grinnell Automatic Sprinkler Literature on the subject of fire protection is always of interest to manufacturers, superintendents and all business men.

**The L. S. Starrett Co., Athol, Mass.,** have issued a handy little folder dealing with their Vernier calipers, which may be had in various sizes and graduated in either or both English and Metric divisions. A section of the booklet is devoted to instructions on "How to Read the Vernier."

**D. Van Nostrand Co., 23 Murray Street, New York,** have mailed us the latest monthly list of scientific books published by them.

**Verity's Ltd. Aston, Birmingham, England,** have sent us illustrated price lists of their English-made Tungsten lamps, and also of their Aston Farm House lighting sets. These consist of a gasoline engine and a dynamo direct-coupled and mounted on one base. An accumulator and switchboard complete an outfit, which is to be recommended on account of its easy portability. These sets are supplied in six sizes, suitable for from 28 to 225 lamps of 20 watts. Prices are quoted in Canadian currency, and are very reasonable.

**The Lunkenheimer Co., Cincinnati, Ohio,** has recently issued an attractive booklet describing their various types of blow-off valves, and they will be pleased to send it upon request.

**The Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa.,** have sent us their circulars No. 1028 and 1190. The first illustrates and describes numerous examples of rotary converters, while the second deals with type E engine-driven A. C. generators.


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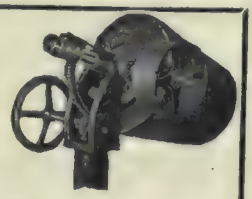

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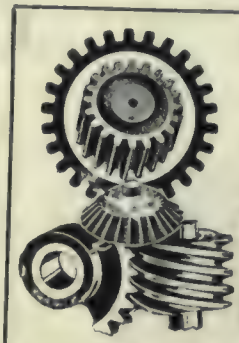

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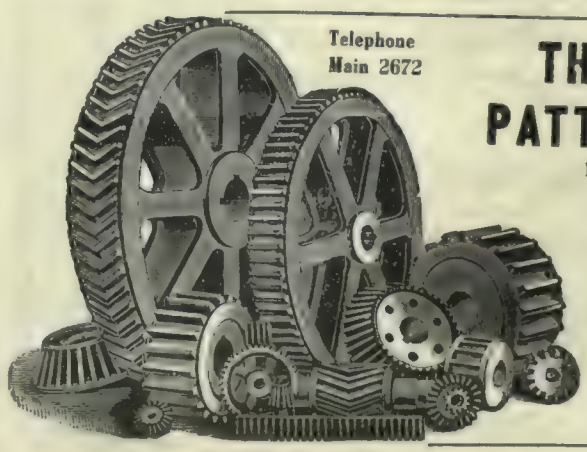

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**The Allis-Chalmers Co., Milwaukee, Wis.,** have forwarded a copy of their Bulletin No. 1083, setting forth the distinctive features of their D. C. generators and showing numerous examples of their application to the direct driving of machine tools.

**The Canadian Gasket Co., Bridgeburg, Ont.,** send us their price list of gaskets. Among other types listed are plain and corrugated copper gaskets, those with asbestos cord-filled corrugated, smooth copper gaskets with asbestos filling, lead gaskets for ammonia fittings, oval gaskets for man-holes, hand-holes, etc.

**Poetter, G. M. B. H., Ltd., Dusseldorf, Germany,** have sent us a copy of their latest catalogue of gas producers, constructed on the Hilger system. These producers have a slowly rotating ash pan and a star shaped grate. Through the rotation of both of these the ash in the producer is kept constantly in motion, thus preventing formation of clinker. Moreover, by these means new surfaces of the fuel are being constantly brought under the influence of the blast, with the result that gasification is greatly hastened. A gas producer of 10 feet internal diameter is claimed to be capable of dealing with 25 long tons of coal or 36 tons of lignite per 24 hours.

**Chambers & Simpson, Engineers, Toronto and Brantford,** have gifted us the handsome leather-bound pocket diary issued by their principals, the Campbell Gas Engine Co., Halifax, England. Besides containing a large amount of highly instructive and valuable data dealing with the various products of that firm, there is a most interesting detailed calendar of prominent occurrences and feast days, and in addition to a neatly arranged memorandum department, an accident insurance coupon contributes to its further possible utility.

**Darling Bros., Ltd., Montreal,** have issued the 1912 edition of their handy little condensed catalogue of steam specialities, feed water heaters, vacuum valves, feed pumps, etc. A double frontispiece shows portraits of the firm's engineers and representatives in Montreal, Toronto, St. John, N.B., Winnipeg and Vancouver. The little book measures 6 x 3½ inches, and is well printed on faced paper.

## BOOK REVIEWS.

**"Street Lighting",** by J. M. Bryant and H. G. Hake, has just been issued as Bulletin No. 51 of the Engineering Experiment Station of the University of Illinois. Efficient and economical street lighting is a subject on which little information of a definite and tangible character has been published. Bulletin No. 51 is designed to supply such information concerning electric street lighting. The subject has been treated in a simple, direct manner, and while of especial interest and value to the technically trained illuminating engineer, will appeal particularly to city councils and central station managers. The general theory and construction of electric lamps, both incandescent and arc, are discussed, together with the standard systems of electric distribution for lighting, and accepted methods for the measurement and study of illumination, with and without shades and reflectors. These principles are then applied to the study of street illumination, curves and calculations being given to show the candle-power distribution for the various lamps used, equipped with their proper glassware and reflectors, and others to show the illumination along the street for representative installations and conditions. Based upon these results, a discussion is given of the proper lighting of business streets, cross streets, boulevards, residence streets and outlying districts. The subject of economy for the several systems and lamps is thoroughly discussed—the initial cost, up-keep, interest and depreciation of various lamps and equipment are considered in tables and curves showing their relative economy at standard costs of power

## STEEL PLANT FOR VANCOUVER.

The coast district of British Columbia is known to be rich in iron deposits of excellent quality, so that it is not surprising to learn that it is proposed to form a company in Vancouver with the object of establishing and operating a steel plant in, or near, the city. Prominent in the undertaking are George M. Gibbs, Vancouver; Henry K. Owens, Seattle, and James D. Sword, Vancouver. It is understood that property containing very large deposits of iron ore has been secured on Louise Island, one of the Queen Charlotte group. It includes nine claims adjoining one another and covering an area of approximately four hundred acres. The ore is said to be extremely rich in metallic iron, and as the present daily consumption of pig iron alone on the Pacific coast is said to be upwards of 750 tons it will be seen that future prospects for a plant of this description are very bright.

## ELECTRICAL MACHINERY, ITS CARE AND HANDLING.

By Roderick Grant, Toronto.

WE are aware how difficult it is to get engineers or attendants, who have had little or no electrical experience, to appreciate how easily a serious fault may develop from what might appear to be a trifling cause, so we would urge the necessity of giving to the brushes, etc., the most careful attention and of taking prompt action to remedy any condition that might conceivably cause trouble. It augurs well if a highly polished dark skin forms on the commutator surface, indicating, as it does, that there is the minimum of wear. The surface then, on no account should be disturbed with sandpaper, for an occasional wipe with a clean dry rag will usually prove to be all the treatment required. It is sometimes advantageous, however, to wipe the commutator with an oiled rag, especially if the brushes become noisy. This treatment also removes any gummy substance present, and which on no account should be allowed to accumulate.

### Defective Insulation Due to Oil Leakage.

At this time of day, when the disastrous results to insulation from moisture or dampness are so well known, it is perhaps needless to insist on the precautions to be observed in that direction, but there is another source from which impaired insulation results equally disastrous, and we regret to say of much too common occurrence. We refer to the indiscriminate use of lubricating oil. It is of course necessary that all bearings should be thoroughly lubricated, but great care should be taken to see that the oil does not overflow, run along the shaft or collect about the frame where it might affect the windings. In most modern machines, the armature is protected by shields on the shaft which arrest the creeping oil before getting to the windings, and manufacturers have given considerable attention to the design of lubricators, to insure that no splashing takes place. The trouble to which we refer, is in most cases, simply due to flooding, and not only is it wasteful but at the same time positively dangerous.

### Bearing Lubrication and Effects of Wear.

Electric motors and generators are as a rule provided with ring lubricators which under favorable conditions give perfect service. An occasional examination should be made, however, to ensure that they are working freely, as a slight deposit of sediment in the oil reservoir will often prevent the ring from being carried round on the shaft. Further, it is not unusual for a ring to spring from its seat by increased vibration, and to

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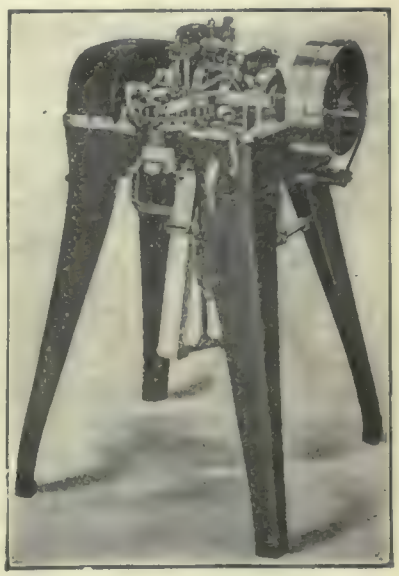

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take up an ineffective position. This trouble can be guarded against by soldering a piece of stout wire across the slot in the bearing wherein the ring lies. Only good clean mineral oil should be used, perfectly free from grit, and the reservoirs should, periodically be thoroughly cleaned out.

Perhaps the chief importance of keeping the bearings in good order lies in the fact that if any wear takes place the armature is thrown out of centre, and the pull exerted by the pole piece toward which it lies becomes tremendous as the neutralizing influence of the opposite pole is lessened. This not only disturbs the magnetic and electrical balance, causing undue heating of the armature and sparking at the brushes, but the wear of the bearings is greatly accelerated until finally the armature rubs on the pole face, damaging more or less severely the insulation. The necessity therefore of keeping the armature exactly central or equidistant from the field magnets will be readily appreciated and frequent inspection should be made in order to ascertain if any wear is taking place. To this purpose, it is advisable where several machines are in use, for the engineer to have at hand a number of flexible strips of wood of the required lengths and thickness. These may be conveniently kept together by means of a ring passing through a hole near one end. Each strip can be inserted in turn and the exact amount of clearance at all points thus readily determined. Although this method is the more reliable the same object may be accomplished by holding a lamp at one end of the armature, when the amount of clearance may be seen from the opposite end. It is possible, however, that the armature may be out of centre without any appreciable wear having taken place at the bearing. A bent shaft, the shifting of one of the field magnets, or a loose armature winding would each contribute to this. In any case, it is no difficult matter to determine exactly what is at fault.

The bearing at the driving or pulley end of the shaft, owing to the extra strain, is subject to most wear. This if once started, for reasons already stated, develops rapidly, so that, on the least indication of this trouble, preparations should be promptly made to have the fault remedied at a time that will cause least inconvenience. The danger of having a bent shaft is not so great, as not only are special precautions taken by all reliable makers to obviate such an occurrence, but it is only under certain conditions that such a thing would be likely to happen. For instance, if the armature were unusually long, the danger would be increased; or if by any chance the machine were allowed to race and exceed its normal rate of speed, the centrifugal force would exert a tendency more or less severe in that direction.

In spite of the precautions that are taken in dynamo and motor design, vibration will sometimes cause a slight displacement of the pole pieces and of the field magnet coils. The measures to be adopted under such circumstances will entirely depend on the manner in which these parts have been fixed, but on the location of the fault, there is seldom much trouble experienced in making the necessary adjustment. Projecting coils on the armature should be pressed carefully and firmly into position and if necessary held by extra binding wire.

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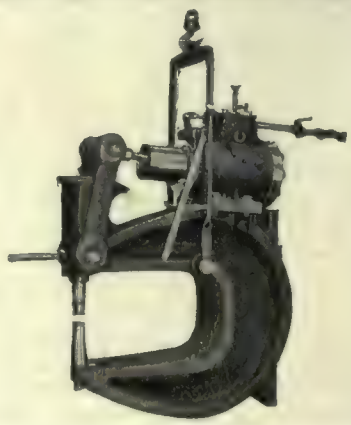


# Herringbone Gears---Features and Applications*

By Percy C. Day, Milwaukee. Wis. **

*This paper relates especially to a type of herringbone gears, known as Wuest gears, after the name of the inventor. The distinctive feature is that the teeth on one side of the centre line of the face are stepped half the pitch ahead of those on the other side, so that they do not meet at a common apex at the centre line, as in the ordinary herringbone type. This arrangement makes it possible to hub the teeth by the aid of special machinery, and to secure great precision.*

THAT the helical principle in toothed gearing is ideal from a theoretical point of view is well known. From a practical standpoint herringbone gears have been less satisfactory than straight-cut spur gears because, until recently, no method was devised for producing them with the requisite speed and accuracy. Within the last six years a method has been found and developed, in England, to a high degree of perfection. Herringbone gears made by this method are called Wuest gears, after the name of the inventor, and can be produced with even greater accuracy than cut gears of the spur type (Figs. 1 and 2).

The distinction between these gears and those of the ordinary herringbone type is that the teeth of the former, instead of joining at a common apex at the centre of the face, are stepped half the pitch apart and do not meet at all. This arrangement of the teeth does not affect the action of the gears, but it facilitates their commercial production and admits the use of precision methods in their manufacture. The utilization of power constantly calls for means to transmit rotary motion from one axis to another and to transform the speed of rotation. While there are many ways in which such transmissions and transformations may be produced, the merits of all of them must be judged from the following standards: (a) reliability and freedom from wear and tear; (b) economy of outlay; (c) mechanical efficiency; (d) compactness; (e) evenness of transmission, absence of shock, jar or vibration; (f) absence of noise. The order of merit may change with different applications, but the same standards obtain for all transmissions. The various methods employed are so well known that they need no discussion here. Let it suffice to say that the spur gear, which satisfies only the first four conditions is used to such an extent that all other appliances are relatively unimportant.

Fig. 2.—Gear and Pinion for 200 H.P. Turbine, to Run at 5,000 ft. per min.

### Action of Spur Gearing.

The aim of all designers of gearing is to transmit rotary motion from one axis to another in a perfectly even manner without vibration of angular velocity. Let us consider the action of a straight spur pinion driving a gear. There are three distinct phases of engagement:

a—First phase.—The root of the pinion tooth engages the point of the gear tooth.

b—Second phase.—The teeth are engaged near the pitch line.

c—Third phase.—The point of the pinion tooth engages the root of of the gear tooth.

Let us assume that the teeth are accurately cut to involute form so that if the pinion moves with even angular velocity it will produce corresponding evenness of motion in the gear. Also that the pinion has sufficient teeth to allow the engagement of successive teeth to overlap.

* Presented at the annual meeting, Dec., 1911, of the American Society of Mechanical Engineers.

** Engineer with the Falk Co.

Fig. 1.—Typical Herringbone Gear and Pinion.

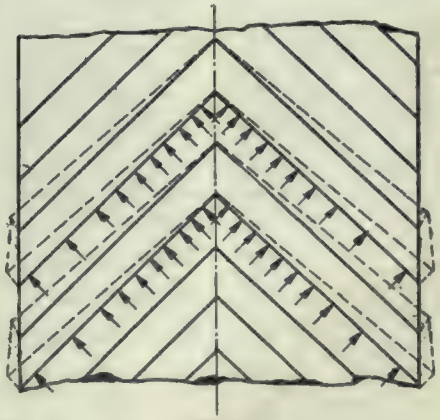


Fig 4.

Fig. 3.

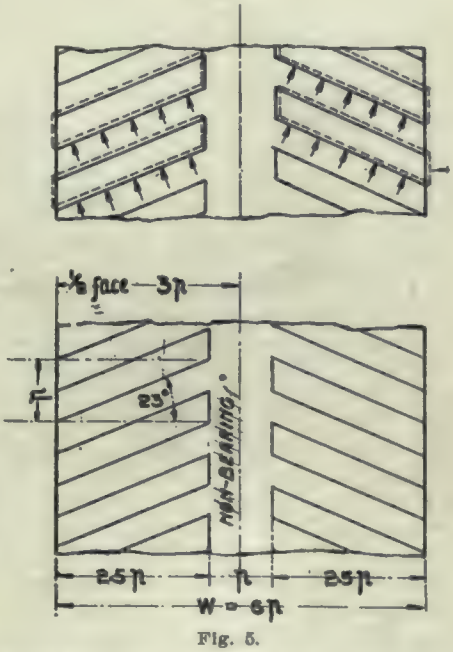



Fig. 5.

Figs. 3 to 5.—Diagrams Showing Tooth Pres sures and Angle Necessary for Continuity of Act ion.

At the beginning of the first phase, while the load is carried near the point of the gear tooth, that tooth is subjected to a maximum bending stress along its whole length. During the first phase, the portion of the pinion tooth near the root is sensibly sliding over the outer portion of the gear tooth; that is to say, two metallic surfaces of small area are sliding under heavy compression.

The action during the second phase more nearly approaches ideal conditions. The teeth are engaged near their respective pitch lines and very little sliding takes place.

During the third and final phase, the pinion tooth is subjected to a maximum bending stress, while the tooth surfaces again slide over each other, this time with the outer portion of the pinion tooth engaging the gear tooth near its root.

The point to be noted is that while those portions of the mating teeth which are near the pitch lines transmit the load with rolling contact, those which are more remote have to transmit the same load with sliding contact. The inevitable result is that the points and roots of all the teeth tend to wear away more rapidly than the portions near the pitch lines, so that the involute tooth curves, necessary to the preservation of even angular velocity, lose their form and the motion becomes uneven. It may be suggested that the sliding action can be got rid of by shortening the teeth so that they engage only the phase of rolling contact. This has been tried with a certain measure of success in the stub-toothed gear, but it cannot be carried far enough without curtailing the arc of contact so that continuity of engagement is lost, thereby introducing more serious trouble than that which it is desired to avoid.

Distortions of gear teeth from involute form, whether due to inaccurate cutting or subsequent wear, give rise to all kinds of trouble. The average angular velocity may be uniform, and yet the passage of each pinion tooth through its brief engagement with the mating gear may be accompanied by successive retardation and acceleration which, though small in itself, takes place in such a short interval of time that it may cause interacting stresses many times greater than the average working load on the teeth. These internal stresses are very difficult to deal with, because they are indeterminate. They cause noise, vibration, crystallization and fracture.

### Action of Herringbone Gears.

Herringbone gears completely overcome all these difficulties, but only when they are accurately cut. The writer will first assume the accuracy and describe the action, afterwards he will endeavor to show how the system under discussion has special features which insure the production of accurate herringbone gears on a commercial scale. If we take two exactly similar pinions with straight teeth and place them side by side on one shaft, with the teeth of one pinion set opposite the spaces of the other, then we have what is known as a stepped-tooth pinion. If this pinion is meshed

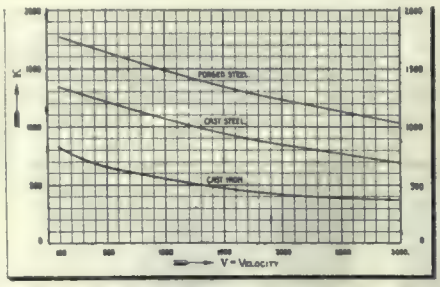
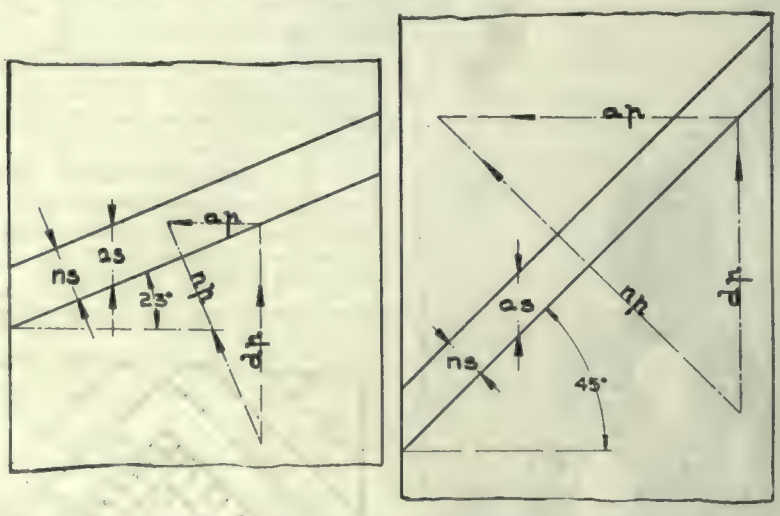



Fig. 7.—Shearing Stress in Relation to Pitch Line Velocity.

with a composite gear made up in a similar manner, the action is modified so that there are always two phases of engagement taking place simultaneously. Such gears are commonly used for rolling mill work, because they stand up to heavy shocks better than the plain type. Still better action can be secured by assembling a number of narrow pinions with the last of the series one pitch in advance of the first and the others advanced by equal angular increments. As a practical proposition, however, gears made on these lines would be costly and difficult to produce.

The helical gear is the logical outcome of the stepped gear carried to its limit, and built up from infinitely thin laminations. Since the steps have merged into a helix, there must be a normal component of the tangential pressure on the teeth, producing end thrust on the shafts. To obviate end thrust, the helical teeth are made right-hand on one side of the face and left-hand on the other. Such gears, with double helical teeth, are known as herringbone gears. The fundamental principle of the action of herringbone teeth lies in the circumstance that all phases of engagement take place simultaneously. This holds good for every position of pinion and gear, provided only that the relationship between pitch, face width, and spiral angle is such as will insure a complete overlap of engagement. Since all phases of engagement occur together, it follows that the load is partly carried by tooth surfaces in sliding contact and partly by surfaces in rolling contact. The result is curious and interesting.

Those portions of the teeth farthest from the pitch line, which engage with sliding action, tend to wear away more rapidly than the portions nearest the pitch line, but the pitch line portion is always carrying part of the load, and the effect of wear on the ends of the teeth merely tends to throw more load on the center portions; in other words there is a tendency to concentrate the load near the pitch lines. The ends of




| | | | |
|---|---|---|---|
| as | AXIAL SECTION | 25° | 45° |
| ns | NORMAL SECTION | ns = .9205 as | .707 as |
| dp | DRIVING PRESSURE | — | — |
| ap | END OF WEDGE PRESSURE | ap = .424 dp | 1.0 dp |
| np | NORMAL PRESSURE | np = 1.09 dp | 1.414 dp |
| | RELATIVE $\frac{np}{ns}$ | 1.19 | 2.0 |

Fig. 6.—Relation of Driving Pressure to Angle of Teeth.

the teeth, instead of wearing away to an ever-increasing extent from their original involute form, are relieved of some of the load from the moment that wear commences to take place. As soon as the load on these ends has been partially relieved and transferred to the middle portion, the wear becomes equalized all over the teeth and they do not tend to distort further from their original shape.

Fig. 8.—Gear and Pinion for 500 H.P. Marine Turbine.

It is quite clear that an unmeasurable amount of wear on the tooth ends will be sufficient to relieve them of all the load, so that the distortion from original form will be practically nothing. The minute extra wear that does take place at the ends is only the amount necessary to transfer such proportion of the load near the pitch lines that the wear is equalized all over the surface of the teeth, those portions in sliding contact carrying less than those in rolling contact. Thus the teeth keep their involute form and motion is transmitted from pinion to gear in a perfectly even manner, without jar, shock, or vibration. Although herringbone teeth may not be intrinsically stronger than straight teeth, the elimination of all shock and indeterminate internal stresses renders them capable of dealing with far heavier transmitted loads. The concentration of the major portion of the load on the parts of the teeth in rolling contact eliminates friction to a marked extent.

Since all phases of engagement occur simultaneously, the transference of the load from one pinion tooth to the next takes place gradually instead of suddenly. This is the second principle of herringbone gearing, and may be termed continuity of action. In straight gears the continuity of action is a function of the number of teeth in the pinion. Straight pinions with less than twelve teeth are seldom made, and more than that number must be used if the drive is to be even moderately satisfactory. In herringbone gears, continuity depends on the relationship between the face width and the number of teeth in the pinion. Pinions with as few as five teeth have been used with success by merely increasing the face width to suit such extreme conditions. This feature, which is peculiar to herringbone gears, has made practical the adoption of extremely high ratios of reduction hitherto considered impossible.

The third principle of herringbone gearing is that the bending stress on the teeth does not fluctuate from maximum to minimum as in straight gears, but remains always near the mean value. This feature is of special importance in rolling-mill driving and work of a similar nature.

To summarize the foregoing arguments:—The action of herringbone gears is continuous and smooth; there is no shock of transference from tooth to tooth; the teeth do not wear out of shape; the bending action of the load on the teeth is less than with straight gearing and does not fluctuate to anything like the same extent; the gears work silently and without vibration; the phenomenon commonly termed back-lash is absent; friction and mechanical losses are reduced to a minimum; herringbone gears can be used for higher ratios and greater velocities than any other kind. These advantages are limited to gears which can be produced with a degree of accuracy which will insure the practical realization of the principle involved.

**The Production of Herringbone Gears.**

Herringbone gears may be produced in a variety of ways which differ from each other as widely as the character of the product. Until a few years ago all gears of this type were molded. The limitations of molded gearing are analogous to those which would be experienced if a journal were set to run in a molded bearing. Just as the bearing would touch the shaft only in spots, so molded gears utterly fail to give the intimate contact all along the teeth which is necessary to secure the realization of true helical gear action. It is obvious that if the teeth touch only in a few high places, they will be subjected to all the evils of shock, stress and inequality of motion which it is desired to avoid. If the gears are particularly well molded, some mitigation may be expected when they become well worn, but initial wear is accompanied by a departure from correct tooth shape. For slow speeds, a well-molded helical gear is no better than a straight gear with cut teeth, and for high speeds it is not as good. The

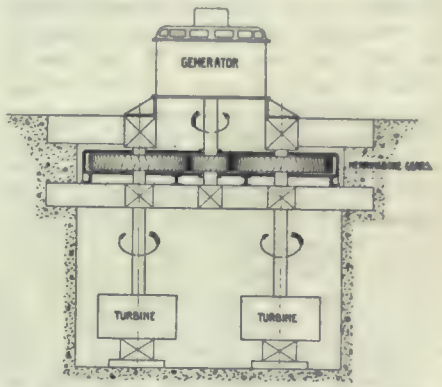



Fig. 9.—Diagram of Gear Connection Between Hydraulic Turbines and an Electric Generator.

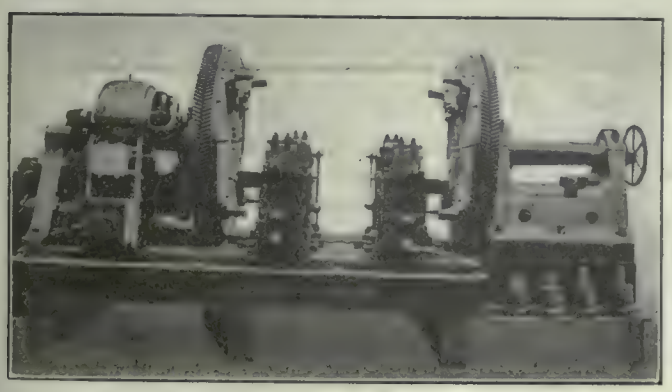


Fig. 10.—Tire Turning Lathe with Herringbone Gears.

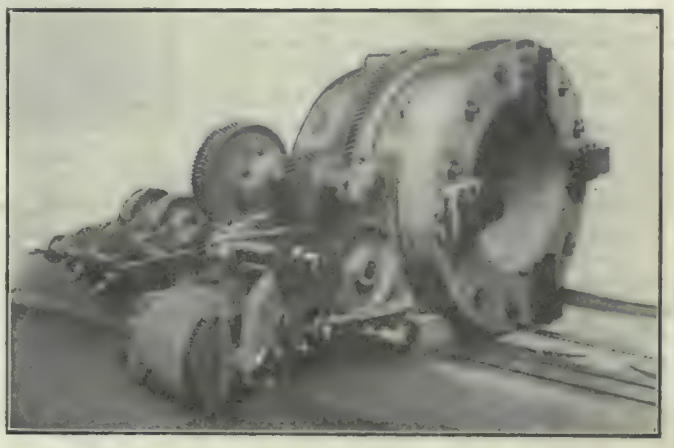


Fig. 11.—Gun Boring Lathe with Herringbone Gears.

natural smoothness of helical action does no more than compensate for the inaccuracies of tooth form and spacing. The modern herringbone gear must have cut teeth if its advantages are to become real.

Cut herringbone gears may be broadly divided into two classes, two-piece and one-piece gears. The difficulty in the way of cutting double helical teeth in a single blank gave rise to the two-piece variety. The same methods of cutting may be used for both kinds. The disadvantages of the two-piece type are fairly obvious. There is the expense of two complete gears, the difficulty of assembling the gears so they are in accurate register with each other, and the necessity for very complete fixing if they are to perform hard service without getting out of register. High ratios, perhaps the strongest feature of the one-piece type, are not within the scope of the built-up gear, because the pinions must be assembled on a separate shaft and the pitch line must be far enough from the surface of the shaft to allow room for the necessary bolts or rivets used in fastening the two portions together. The one-piece pinion, however, may be cut solid with its shaft, so that its pitch diameter need be but very little larger than the latter. The known methods of cutting helical gears may be divided into four classes: (a) milling by formed disc cutters; (b) milling by end mills; (c) generating by shaping or planing methods; (d) generating hobs.

Milling by formed disc cutters is unsatisfactory because, in addition to the usual errors of step-by-step division, there is the difficulty of making the cutters to the normal tooth shape with sufficient accuracy to insure correct circumferential shape for the gears cut. This difficulty is increased by reason of the fact that a disc cutter cannot cut its own shape in a spiral groove. Let it be noted that the cutters must be formed empirically, that their number must be very large to meet the requirements of a general gear business, and that the accuracy of each gear turned out depends on the combined efforts of the toolmaker and draftsman who produced the cutter. Worst of all, two different cutters must be used for a gear and pinion. This method will produce indifferent herringbone gears which may be built up with teeth in register or made in one piece with staggered teeth.

The use of end-mills is open to all the objections given with regard to disc cutters, with the single exception that the cutter does leave a fair approximation to its own shape in the groove which it cuts. The end-mill has a host of disadvantages peculiar to itself which render it even less efficient than the disc cutter for general work. In the first place, it is a small tool with very little wearing surface and no capacity for dissipating the heat generated at its cutting edges. The great variation in diameter between point and base renders it difficult to arrive at a cutting speed which will satisfy the conditions at both ends of the cut. When used for any but the largest pitches, outside the range of general gear practice, the mills quickly become clogged with cuttings, overheat and burn. A burnt end-mill, clogged with cuttings, produces a wider groove than a good mill. This is a fruitful source of spoiled work. To complete one fair sized gear by the end-mill process requires quite a number of cutters. This not only makes the expense heavy, but must necessarily result in an inaccurate gear.

Every cutter used must be formed to gage and hardened. After being hardened, it will run out of true a little in most cases, thereby cutting a shape different from that for which it was designed. In end-mill gears it is not merely a case of getting accurate conjugate tooth shapes in gear and pinion made with different cutters, but the teeth in a single gear may have a dozen different shapes. The process is so slow that it cannot compete with other methods, quite apart from the doubtful quality of the gears produced.

End-milled herringbone gears are usually made in one piece with the teeth joined at the center. Since the cutter is shaped to the normal pitch, it follows that, in changing over from right to left hand helix, it leaves a thick wedge in the center of the face that must be removed by a subsequent operation. The teeth of end-milled herringbone gears do not bear over the center portion.

Generating processes by the shaping and planing types, while successful for straight-cut gears of relatively small size, are not used to any extent for large diameters or heavy pitches. The reason for this may be found in the nature of such processes. The gear blank is required to make a quick angular movement after each stroke of the cutting tool and to come to rest again before the next stroke. Such methods are difficult to apply to large gears on account of the inertia of the gear blank and its support and the consequent difficulties of controlling the short intermittent movements. These difficulties are much increased when such methods are applied to cutting helical teeth because the blank must make definite and rapid angular movements during each stroke in addition to the motion between strokes. No machine has been devised which will satisfactorily deal with the problem on these lines.

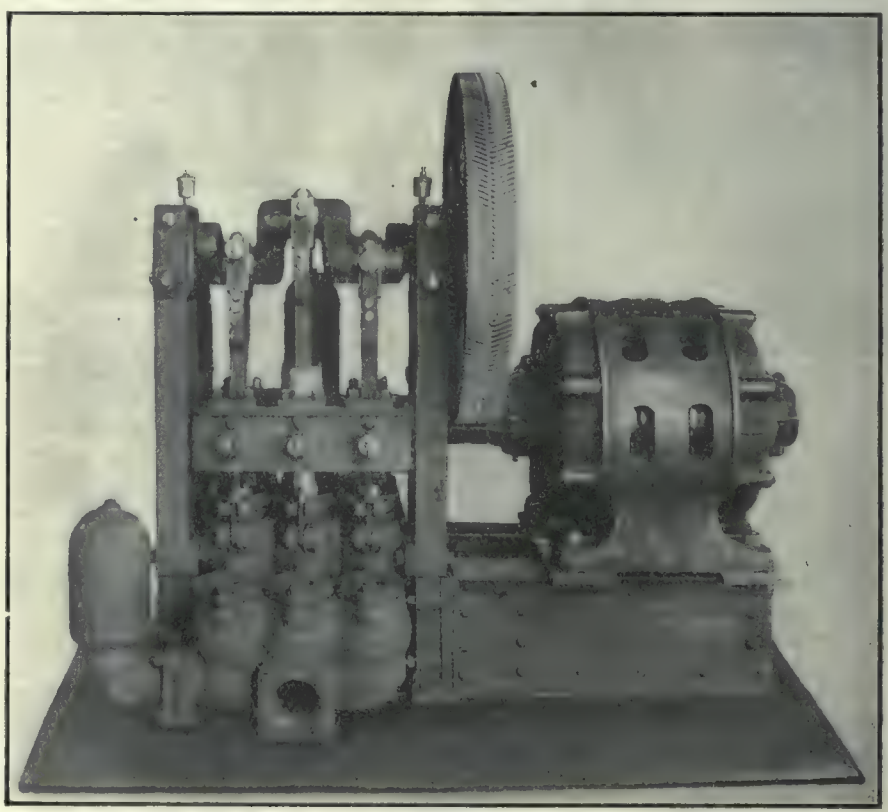


Fig. 12—Herringbone Gears Applied to Electrically-Driven Triplex Pump.

The hobbing process as supplied to straight-cut gears has proved so successful as to arouse a storm of adverse criticism from those who are interested in other methods of gear production. It is not difficult to understand why this process has sprung into prominence in a comparatively short time. It is essentially a rational process. The shape of the teeth is generated from spiral hobs,

the threads of which are cut to a plain rack section. There is nothing empirical about a hob; it is a straightforward thread cutting, gashing and relieving proposition. One hob will cut any gear or pinion of one pitch. This feature alone eliminates a host of errors which are characteristic of gears produced by milling methods. The hob revolves continuously while cutting, as does the gear blank. The feed is also continuous. There are no cutting and return strokes, no intermittent starting and stopping of gear blanks, as in other generating processes. These features do not necessarily insure the production of accurate gears, but they offer greater facilities to the designer for the achievement of the desired result. The hob is a substantial tool with plenty of wearing and cooling surface, it can be made to stand up to very fast production and to last for a long time. The continuous nature of all motions used in hobbing a gear blank enables this process to be used for the production of the heaviest gears, there being no limitations such as are encountered in other processes. The limit to the size of a hobbing machine is set by the dimensions of the largest gears which are required in sufficient quantities to pay for the investment. There are no technical limits whatever. Nevertheless there are some slight defects in the hobbing process as applied to the production of straight-cut spur gears. A hob is a worm thread, and as such must have a spiral angle depending on the relationship between the pitch of the thread and the diameter of the hob. A straight-cut gear has no spiral angle, hence the spiral hob must be inclined, more or less to bring the cutters in line with the tooth spaces to be cut. In order to cut correct teeth, the axis of the hob should be perpendicular to the axis of the gear blank. In such case the hob will generate involute teeth if its threads are cut to the same axial section as the straight-sided parent rack for the required pitch. Since the hob must be inclined to cut a spur gear, the teeth are not generated from the axial or rack section, but from a diagonal section. The axial pitch of a hob for cutting spur gears is not the same as the pitch of the gears which it cuts. The normal pitch of the hob threads must be the same as the gear pitch.

Hobs for cutting straight spur gears are usually made of large diameter to reduce the spiral angle and consequent errors of tooth form to a negligible minimum. As a natural consequence, such hobs have only one thread, while their large diameter requires a slow speed of rotation to keep the cutting speed within proper limits. The effect of this is that the blank revolves very slowly, and a coarse feed must be used to keep up the output. It is one of the peculiarities of each hob action that only one tooth of the hob puts the finishing touch to the bottom of a tooth space once in each revolution of the gear blank. If the feed is coarse, there will be noticeable feed marks and roughness in the gear teeth produced. A coarse feed used with a hob of large radius throws severe stresses on the hob arbor and its supports. The necessity of a swivel motion on the hob slide, to enable straight spurs to be cut with hobs of varying spiral angle, compels the use of a hob drive which passes through the pivot. It is almost impossible to design such an arrangement without undesirable restriction in the dimensions of driving gears and shafts combined with excessive overhang of the hob arbor in relation to its supporting slide.

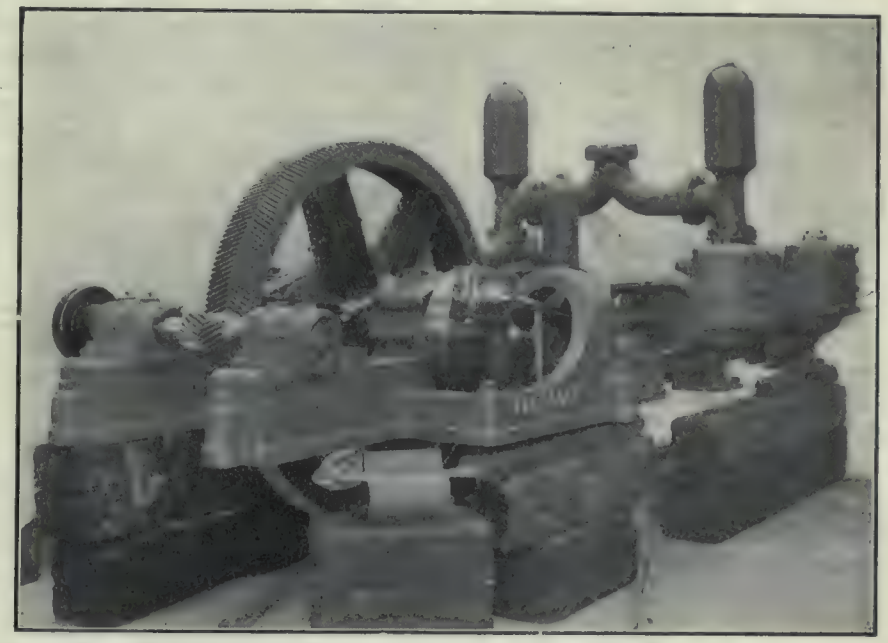


Fig. 13.—Gear-Driven Horizontal Pump, Gear Ratio 12¼ to 1.

The general want of rigidity about most hobbing machines used for the production of spur gears, is traceable to the above causes. Rational critics of the hobbing process have based their objections on these features.

The hobbing process properly applied to the production of herringbone gears has none of the disadvantages, incidental to its application to spur gear cutting, which have been shown to lie in the necessity of inclining the hob axis. Since a helical gear and a hob must both have a spiral angle, it is only necessary to make the thread angle of the hob the complement to the corresponding angle of the gear teeth to secure the advantages of perpendicular fixed axes. These are of great practical value. Since the hob axis is always perpendicular to the axis of the gear blank, it follows that the teeth are generated from the axial and true rack section of the hob, while the linear pitch of the hob is the same as the circular pitch of the gear which it cuts. The hob axis is fixed and the hob can be supported on a rigid slide with the minimum of overhang. There is no restriction to the size and strength of the gears and shafts used to drive the hob.

### Wuest Herringbone Gears.

It has been explained that the teeth of the Wuest gears are so designed that those on the right and left-hand sides of the gear are stepped half a space apart and do not meet at a common apex at the center of the face, as in the usual type of herringbone gear. It has often been argued that the ordinary herringbone tooth is stronger than the Wuest tooth, because the latter lacks the support given by the junction of the teeth at the center. This argument would be sound if gear teeth were ever stressed to anywhere near their breaking point, but it has been found in practice that considerations of wear so far outweigh those of mere breaking strength that a gear which is designed to give reasonable service will carry anywhere from ten to twenty times the working load without fracture. A point of vastly greater importance is that the stepped form will wear more evenly under extreme loads than the ordinary type. The reason for this is shown in Figs. 3 and 4. The resultant tooth pressure is always normal to the teeth and tends to bend them apart. The stepped form offers a uniform resistance along its whole length, carrying the load from end to end, Fig. 3. The teeth of ordinary herringbone gears tend to separate more at

the sides than near the supported centre, causing the load to be concentrated toward the centre, Fig. 4.

Any system of gearing, if it is to be generally applied, must be interchangeable. The variable features of involute spur gear teeth are limited to the pressure angle, addendum and dedendum. In a herringbone-gear system, we must have besides, uniformity of spiral angle and relative position of the right and left-hand teeth. The standards which have been adopted for Wuest gears are the result of experience gained in Europe during the last six years. The spiral angle of the teeth is about

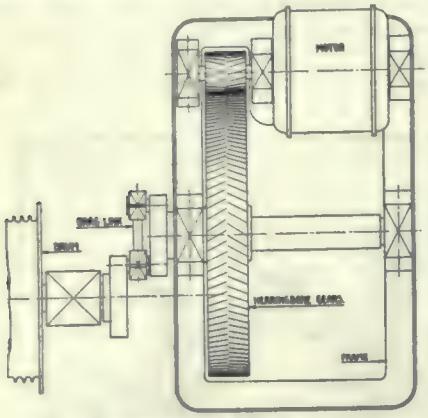


Fig. 14.—Electrification of Mine Hoist, Formerly Steam Driven.

23 deg. with the axis. The choice of this angle is controlled by a number of considerations, the most important from the user's standpoint being that the angle must be sufficient to allow the engagement of successive pinion teeth to overlap within a reasonable face width. Once this condition is satisfied, there is no advantage in an increase of spiral angle, while there are disadvantages in the use of steep angles. It was necessary, before choosing a definite spiral angle, to determine what constitutes a reasonable face width for this class of gearing.

Since the nature of the action eliminates shock, it follows that the pitch required for given conditions will be much finer than would be chosen for spur gears. On the other hand, the face width will not be less, because there is as much necessity for wearing surface with one kind of tooth as with the other. Spur gears are usually made with face width equal to three or four times the pitch. Herringbone gears may conveniently have a face width equal to six times the pitch not because the width of this type need actually be greater, but by reason of the pitch being proportionately less.

Starting with a width equal to six times the pitch, and allowing once the pitch as the non-bearing portion in the centre, there remains two and one-half times the pitch available for the teeth on each side. To ensure continuity of engagement under all ordinary conditions, each tooth is inclined so as to cover an advance of once the pitch within its length. The angle of 23 deg. satisfies the requirement, see Fig. 5. There are a few cases where an angle less than 23 deg. would be sufficient, a steeper angle is only needed if the available face width has to be unduly restricted. Neither of these extreme conditions should influence the choice of angle for an interchangeable system best adapted for general use.

There are other good reasons why a moderate spiral angle is to be preferred. In all spiral gears the pressure acts in a direction normal to the teeth and is the resultant of the tangential (driving) and axial pressures. The normal pressure becomes greater in proportion to the useful driving pressure as the spiral angle is increased, while the available normal tooth section becomes less, Fig. 6. When the spiral angle is sensibly steeper than the angle of repose for the materials in contact, there is a tendency for the teeth to bind with a wedge action. Herringbone gears with abnormally steep spiral angles show loss of efficiency and increased wear from this cause.

The pressure angle which has been adopted for standard gears is 20 deg. The teeth are shorter than the usual standards, with addendum 0.8 and dedendum 1.0. These standards of tooth height and pressure angle have been adopted after systematic trials and experience extending over several years of regular manufacture. The high ratios used with these gears call for an average pinion diameter which is less than that used with straight spur-gears for similar duty. The teeth are generated by hobs, and the short adendum combined with wide angle gives satisfactory tooth shapes, without undercutting of

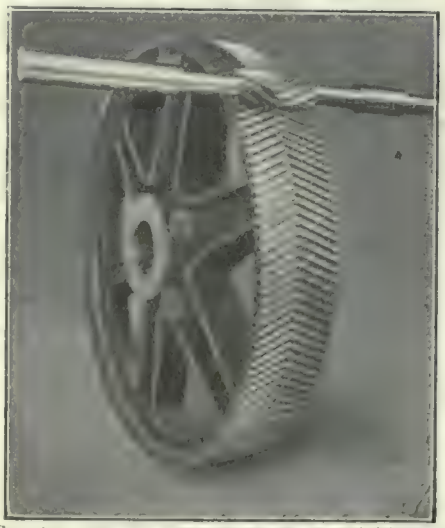


Fig. 16.—Typical High Ratio Gear and Pinion, the Latter with 8 Teeth.

teeth, for small pinions. Pinions with very few teeth are cut on the well-known system of enlarged addendum which is used for small wormwheels and bevel pinions. The teeth are cut to diametral pitch standards, measured circumferentially as with ordinary spur gearing.

### Dimensions for Proposed Interchangeable System.

The dimensions proposed for an interchangeable system for these gears are as follows:

Tooth shape ..... .....Involute.
Pressure angle .... ..... ....20 deg.
Spiral angle ..... ..... .....23 deg.
Pitch diameter (20 teeth and over)= Number of teeth

$$\frac{\text{Number of teeth}}{\text{D.P.}}$$

Blank diameter (20 teeth and over)= Number of teeth+1.6

$$\frac{\text{Number of teeth}+1.6}{\text{D.P.}}$$

Pitch diameter (under 20 teeth)= 0.95×Number of teeth+1

$$\frac{0.95\times\text{Number of teeth}+1}{\text{D.P.}}$$

Blank diameter (under 20 teeth)= 0.95×Number of teeth+2.6

$$\frac{0.95\times\text{Number of teeth}+2.6}{\text{D.P.}}$$

$$\text{Addendum} = \frac{0.8}{\text{D.P.}}$$

$$\text{Dedendum} = \frac{1.0}{\text{D.P.}}$$

$$\text{Full depth} = \frac{1.8}{\text{D.P.}}$$

$$\text{Working depth} = \frac{1.6}{\text{D.P.}}$$

Standard face width for gears with pinions of not less than 25 teeth .....6 times circular pitch

Face widths for high ratio gears with small pinions 6 to 12 times circular pitch

When a pinion of less than 20 teeth is used with a standard gear, the centre distance must be slightly increased to suit the enlargement of the pinion. If it is desired to keep the centre distance to the standard dimensions, the gear diameter may be reduced by the amount of the enlargement given to the pinion. For example:—If a pinion of 10 teeth, 5 D.P. is to mesh with a gear of 90 teeth at 10 in. centers.

Pitch diameter of pinion=

$$\frac{0.95\times10+1}{5}=2.1 \text{ in.}$$

Enlargement over standard pinion= 0.1 in.

Pitch diameter of standard gear $= \frac{90}{5} = 18.0$ in.

Reduced pitch diameter of gear $= 18.0 - 0.1 = 17.9$ in.

Centre distance $= \frac{17.9 + 2.1}{2} = 10$ in.

Strictly speaking, there can be no enlargement or reduciton of the pitch diameter in a pinion or gear of given pitch and number of teeth. It is convenient to assume this enlargement and reduction, while using teeth with long and short addenda but standard depth.

In these gears the teeth need not have the same breaking strength as with spur gears because they have not to combat the heavy and indeterminate stresses which arise from inequalities of angular velocity. On the other hand it is necessary to provide against rapid wear. By using a finer pitch, each tooth has less individual wearing surface, but this is more than compensated for by the larger number of teeth in simultaneous contact than with gears of equal diameters but coarser pitch. In high ratio gears, using pinions of exceptionally small diameter, the pitch is finer than for ordinary ratios, but the face width is extended to give the proper wearing surface. The important factor in determining the proportions of the teeth is the relationship between pitch line velocity and the permissible specific tooth pressure; in other words, the total tooth pressure divided by the area of all the available simultaneous contact along the teeth. Theoretically, this contact has no area since it should consist of lines without breadth. Actually, an area exists, due to the elastic compression of the teeth in contact, in a similar way in which an area of contact exists between a car wheel and a rail. The area of contact is indeterminate, but the specific tooth pressure is proportional to the driving stress on the teeth.

### Simple Rule for Finding Proper Dimensions.

In order to obtain a simple rule for finding the proper dimensions, the results of experience in the matter of safe working loads under given conditions have been reduced to a relationship between pitch line velocity and the shearing stress on the pitch line thickness of an imaginary straight tooth, assuming only one tooth in engagement at a time. The shearing stress is a measure of the specific tooth pressure. and the relationship referred to affords a convenient means of arriving at reliable dimensions. The curves, Fig. 7, give values of shearing stress K in pounds per square inch on pitch line section of an imaginary single tooth for corresponding pitch line velocities V in feet per minute. The values are entirely empirical, but they are based on the results of extended experience, and lead to dimensions which are safe and reliable. Different curves are given for different materials, and it is necessary to use that curve which corresponds to the lowest grade material of the combination. The dimensions of gears can be derived from the curves in the following manner:

h.p.=brake horsepower transmitted

N=revolutions per min.

D=pitch circle diameter, in.

p=circular pitch in inches (use nearest diametral pitch)

W=total width of face, in.

V=pitch line velocity, ft. per min.

P=total tooth pressure at pitch line, lb.

K=stress factor (from curve)

$$V = \frac{nDN}{12} \quad \ldots\ldots\ldots\ldots\ldots\ldots [1]$$

$$P = \frac{\text{h.p.} \times 33{,}000}{V} \quad \ldots\ldots\ldots\ldots\ldots\ldots [2]$$

$$P = \frac{pWK}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots [3]$$

$P = 3p^2K$ (in normal gears of moderate ratio, and face width equivalent to six times the circular pitch)..... [4]

$$p = \sqrt{\frac{P}{3K}} \quad \ldots\ldots\ldots\ldots\ldots\ldots [5]$$

For high ratio gears take $W = Rp$ ($R$= ratio to 1) up to maximum of $W = 10p$.

$$p = \sqrt{\frac{2.5P}{RK}} \quad \ldots\ldots\ldots\ldots\ldots\ldots [6]$$

Usually the values of h.p. and N are known. In many cases the diameters or centre distances are fixed, and there is no choice of dimensions. When the diameters are not fixed there are many solutions to the same problem and it becomes largely a matter of experience which to select in order to obtain the

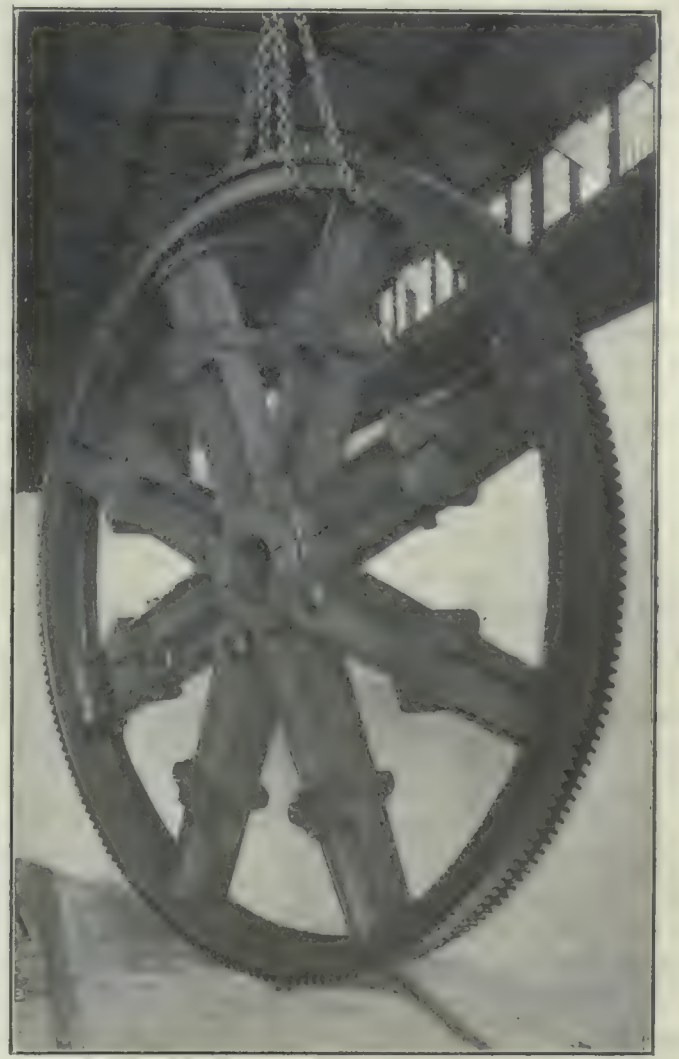


Fig. 15.—Semi-Steel Gear, 12 in. Face, 12 ft. Diameter for Mine Hoist.

most economical and satisfactory gears. In normal gears it is safe to aim at pitch line velocities between 1,000 and 2,000 ft. per min. with 1,500 ft. as a fair average. If the pinion is to be fixed to a motor shaft without external support, the diameter must be greater than when it can be supported on both sides. Cast-iron is preferable to cast-steel for gears of large diameters and moderate power, but the latter will be found more economical for high tooth pressures. Pinions are usually made from steel forgings of 0.40 to 0.50 per cent. carbon. Soft pinions should never be used for herringbone gears. Besides being bad engineering practice they are unnecessary, because steel pinions run without noise and last much longer.

### Typical Instance.

The following is a typical instance of the range of choice in dimensions:—A pump which requires 150 h.p. at 50 r. p.m. is to be driven from a motor at 500 r.p.m. with shaft end 4½ in. diameter. It the shaft is unsupported, it is not desirable to use a pinion of less than 10 in. If the shaft is extended to a third bearing a 7½-in. pinion can be used. If the pinion is cut solid on its shaft and coupled to the motor, its diameter can be reduced to 5 in. The three arrangements work out as follows:

| | | | | | Material for Gear | V | P | K | Diametral Pitch | Face Width |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 10 | in. and | 100 | in. | Cast-iron | 1300 | 3800 | 500 | 2 | 9½ |
| B | 7½ | in. and | 75 | in. | Cast-iron | 975 | 5100 | 530 | 2 | 12 |
| C | 7½ | in. and | 75 | in. | Cast-steel | 975 | 5100 | 1060 | 2½ | 7½ |
| D | 5 | in. and | 50 | in. | Cost-steel | 650 | 7600 | 1150 | 2½ | 12¼ |

Any of the above gears will do the work satisfactorily. C is the most economical, but B or D would make the least noise. If a gear case is to be provided, then D will give the most economical combination.

The foregoing data can be used for finding the required dimensions of herringbone gears for all general applications. In most cases it is sufficient to calculate the tooth pressure from the average working load. When the maximum load is very far in excess of the average, it is usual to take a mean value between the two. Gears for electric mine hoists and single throw pumps fall within this category. Machine tools, when driven from variable-speed motors, are required to perform maximum duty at minimum speed only for short periods at long intervals. It is sufficient when getting out gears for a drive of this kind to reckon with the rated output of the motor at the mean between its maximum and minimum speed.

There are two special cases where the ordinary methods of calculation should not be used. Rolling-mill gears are subjected to stresses which are so far in excess of the average working load that it is necessary to consider carefully the strength of the teeth in regard to possible overloads. Extra high velocity gears, such as are used for steam turbines, require additional wearing surface and are characterized by extreme width of face combined with abnormally fine pitch. These are two extremes in gearing and their design is best left to those who have made a special study of them.

### Summary of Gear Features.

Before describing some special applications of these gears to the needs of various industries and machines, it may be of service to summarize the salient features of the gears and the changes of viewpoint which these features have engendered. The smooth and continuous action is virtualy independent of the diameter or number of teeth in the pinion.

Extremely high ratios of reduction can be used without fear of uneven driving or undue wear and without fear for unwieldy gear diameters which would be disproportionate to the general design. High ratio gears of this type transmit power with practically no more loss than low ratio gears. They are far more efficient than belts, ropes, worm-gears or compound trains of spur gearing, while their adoption results in a wholesale reduction of countershafts and bearings which reduces the power consumption and running costs to a remarkable degree.

There are many instances where spur gears cannot be used because the vibration which they set up has a detrimental effect on the driven machine or its product. The inconvenience of a cumbersome system of belts or ropes has usually to be borne in such cases, but it is not too much to say that the requirements of almost all of them are fully satisfied by this type of herringbone gears.

The application of spur gears has been much restricted by the noise which they make when run at high velocities. The use of rawhide or other soft materials has only proved moderately successful for comparatively light work and is quite unsound for heavy gear practice. Herringbone gears in combination with durable steel pinions make less noise than soft pinions and spur gears when new, and while the former become quieter with use, the latter soon begin to rattle as they become worn. It should be noted that the use of soft pinions, while mitigating the nuisance of excessive noise, does not reduce vibration or unevenness of motion.

There is a limit to the pitch-line velocities at which spur gears can be operated and beyond which it is unsafe to use them. This limit is far below the minimum velocities which can be used in connection with steam turbines of economical design and high power. Accurate herringbone gears operate quite smoothly at velocities which are impossible for other types. This feature would appear to reserve for them a field of application which has great possibilities and is likely to cause some great changes in the standard practice of to-day.

### Application to Steam Turbines.

There are many instances when the power of the turbine can be more conveniently applied in mechanical form than through electrical transmission. The advantages of high-power turbines have been discounted in many instances by the necessity for expensive electrical outfits with their attendant losses of generation, distribution and conversion.

Direct-connected steam turbines for marine propulsion have been only partially successful in a very limited field. The screw propeller, working in a dense medium, has an economic speed of rotation which is far below the best speed for a steam turbine of corresponding power. It is only when the power required is very great and the speed of the vessel unusually high that the direct-connected turbine can be applied, and even then the application does not do full justice to either turbine or propeller, while the first cost is much higher than it need be. The use of direct-coupled turbines is confined to ocean fliers and ships of war. Ordinary vessels of commerce, which are built in vastly greater numbers, cannot be adapted to turbine power in this form. Mr. Parsons attacked the problem of applying the turbine to an ordinary freight steamer of moderate power. To this end he purchased the S. S. Vespasian, a modern tramp with triple-expansion engines of about 1,000 h.p. and a speed of 11 knots with propeller running at 75 r.p.m. As a preliminary to the installation of geared turbines on this vessel, the original engines were overhauled and tuned up and a series of coal consumption trials made under regular sea-going conditions.

The engines were then removed and for them were substituted a pair of steam turbines connected to the propeller by the herringbone gears illustrated in Fig. 8. Each turbine develops about 500 h.p. at 1,500 r.p.m. The propeller runs at the original speed of 75 r.p.m. Each turbine is coupled to a herringbone pinion

with teeth cut solid on a shaft of soft-grade chrome nickel steel. The two pinions mesh with rolled-steel gear rings mounted on a cast-iron spider which is keyed to the propeller shaft. The whole gear system is enclosed in a case, and the teeth are kept lubricated by oil jets. The great width of the pinions in proportion to their diameter made it necessary to provide room for bearings between the right and left-hand teeth. The proportions of this remarkable gear unit are as follows:—Pinions, 20 teeth; gear, 398 teeth, 4 diametral pitch; teeth of involute form, 20 deg. pressure angle, 23 deg. spiral angle; over-all face width, 34 in. including 10 in. space for bearing; actual face width, 24 in.; ratio of reduction, 19.9 to 1.

**Satisfactory Results Obtained.**

This gear has now been running regular voyages for more than a year and has covered over 20,000 miles. The results have been interesting and satisfactory. The efficiency of the gear is fully 98 per cent., including the losses in the bearings on the gear case. The geared turbine shows a sustained all-round saving in fuel consumption of more than 25 per cent. over the original engines. The gear runs with remarkable smoothness and without noise or vibration. The wear on the teeth is negligible after 20,000 miles, being only 0.002 in. at the pitch lines of the pinions. Even this small wear is nearly all traceable to inadequate arrangements for freeing the oil from grit during the first runs.

Not by any means the least important gain is in the behavior of the vessel in rough water. There has been no racing of the propeller under circumstances where this disagreeable feature was painfully evident with the original installation. This is due to the high rate at which the turbine motors store up energy with change of speed, which makes it impossible for a large change to occur during the time when the propeller is partially uncovered. Such a record as this is so conclusive that the use of geared turbines for marine propulsion must shortly become general. Herringbone-geared turbines aggregating 3,600 h.p. have recently been fitted to the U.S.S.S. Neptune by the Westinghouse Machine Company. The performance of this vessel will be awaited with interest.

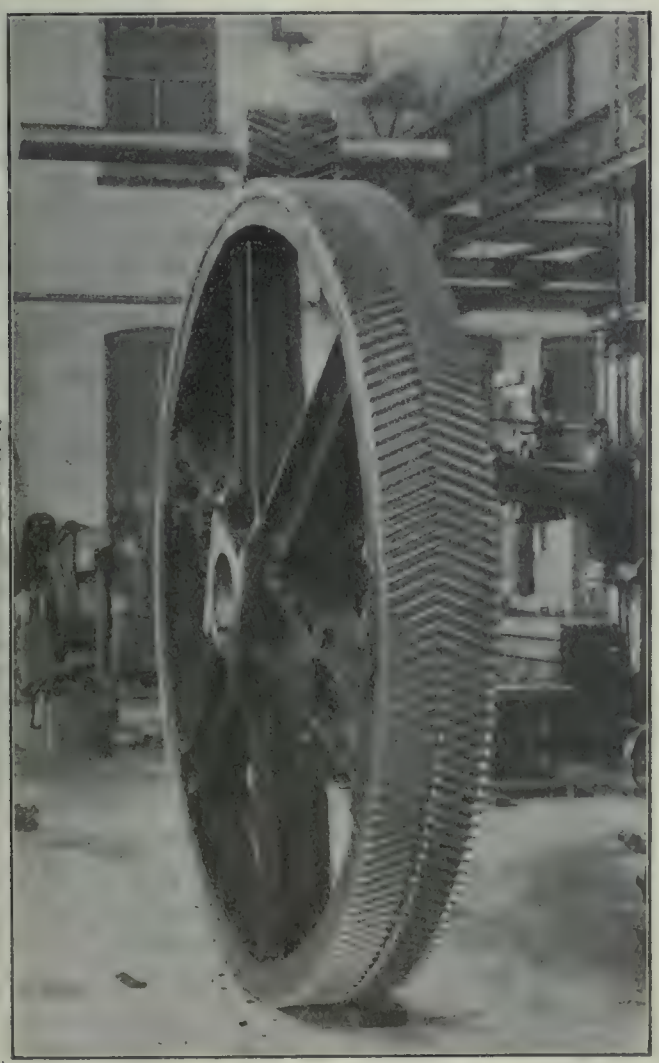


Fig. 17.—High Ratio Pump Gears, Gear 9 ft. Diameter.

**Continuous Plate Mill Installation.**

Mr. Parsons has made a successful introduction of herringbone gears in combination with a steam turbine for driving a continous plate mill. This is a proposition which few engineers would have considered seriously, yet it has proved a success from every point of view. The mill is of the three-high type with rolls 28 in. by 84 in. running at 70 r.p.m. The turbine is designed for mixed pressure, running at 2,000 r.p.m. with exhaust steam at 16 lb. absolute or live steam at 60 lb. absolute and giving 750 b.h.p. The turbine is coupled to the rolls through a double train of herringbone gears. The first train consists of a chrome nickel steel pinion, cut solid on its shaft and cast-steel gear. Pinion and gear have 25 and 131 teeth, 3½ diametral pitch by 24 in face. This train reduces from 2,000 to 375 r.p.m. and is coupled to the second train through a flexible coupling. The second train includes a high carbon steel pinion of 23 teeth and cast steel gear of 127 teeth, 2 in. circular pitch by 16 in. face. This train reduces from 375 to 70 r.p.m. The final gear is overhung on the end of a flywheel shaft 22 in. in diameter, which carries a flywheel of about 100 tons between two bearings and is coupled to the main pinion through a pair of wobblers. Both sets of gearing are enclosed in casings and are lubricated by oil jets from a pump provided for the purpose. This mill has been running without a hitch of any kind since September 15, 1910. The gears are noiseless, the installation shows remarkable efficiency, the rolls run with extreme smoothness and the pinions do not show appreciable wear.

**Scope of Geared Turbine.**

The success of the geared turbine for such an application as the one described makes it certain that similar arrangements can be used with advantage for driving textile and other mills where the conditions are less severe. The geared turbine is making rapid progress for driving direct-current generators, and several large sets are now running and in course of construction. Hitherto, it has been usual to couple the turbine to a high-speed alternator and to convert to continuous current through a motor generator or rotary converter. The geared turbine unit costs less money, takes up less space and has an overall efficiency at least 6 per cent. better than the A.C.—D.C. combination.

Geared turbines have another field of application for driving centrifugal pumps. Direct driven units of this kind have poor efficiency because a compromise has to be made between turbine and pump speed which is detrimental to both. The interposition of a set of herringbone gears allows both ends to be constructed for the highest economy, and since the

loss in the gears does not exceed 2 or 3 per cent. there is a large all-round gain in efficiency. This applies also to turbine-driven blowers and fans.

**Geared Hydraulic Turbines.**

The speed of hydraulic turbines is controlled by the available head of water supplied to them. The greater number of turbines are required to operate under low heads and must run at slow speed. Hydro-electric power has usually to be transmitted to a considerable distance and is produced in the form of alternating current of definite periodicity. The speed of the turbines may be as low as 50 r.p.m. or even less. A large direct-coupled alternator for this speed is an expensive proposition.

Herringbone gears can be used to speed up from the slow-running turbines to generators of normal design, speed and efficiency. The smooth action of these gears is unimpaired when the wheel drives the pinion, and high ratios of speed increase can be obtained from them without noise and with less loss than direct coupled units will give. A typical installation of this kind is outlined in Fig. 9. This arrangement shows two slow-speed vertical turbines driving one generator. A herringbone gear is mounted on each turbine shaft and both gears mesh with a pinion which is coupled to the generator.

**Rolling Mills and Rod Mills.**

There are two advantages in the use of accurate herringbone gears for this class of work. The absence of shock in transmission renders breakages much less frequent than with cut spur or moulded helical gears. The even transmission and entire elimination of vibration allows the finishing rolls to be gear driven for the finest work without showing gear marks on the finished product. Herringbone-geared mills run with very little noise. This may be of less consequence in rolling mills than in most other applications, but it is an improvement. Rod mills, with their quantities of high-speed gearing, can be completely transformed by using herringbone gears and mill pinions.

**Machine Tools.**

The field for accurate herringbone gears in connection with machine tool driving is too extended to be considered in detail. For individual motor drives this gear gives a positive transmission which is free from vibration and less noisy than so-called silent chains or rawhide pinions, while there is no trouble from slipping belts or slack chains. But the real advantage of these gears lies in the better finish that can be obtained when they are used for the entire main transmission, and in the higher output combined with reduced maintenance which they give to heavy machine tools. Chatter is eliminated. Even the speeding up to the wheels of grinding machines has been successfully accomplished. Reversing gears for heavy planers are a revelation to those familiar only with the ordinary spur drive. Illustrations of machine tool drives are shown in Figs. 10 and 11.

**Pump Driving.**

Electrically-driven plunger pumps have not enjoyed the popularity that might be expected, due to the noise and vibration caused by the gearing between motor and pump shaft. These objections are obviated by accurately cut herringbone gears, which not only give silent and vibrationless transmission but admit the use of high ratio single reductions with compact dimensions. The single reduction drive has a much higher efficiency than the ordinary double frame, quite apart from the lower gear losses, because at least one countershaft can be dispensed with. Examples of such drives are shown in Figs. 12 and 13. Similar drives are successful for air compressors and vacuum pumps which present similar difficulties to those met with in plunger pumps.

**Application To Mining.**

One of the features in the recent electrifications of the Eckstein group of mines on the South African Rand is a train of herringbone gears between motor and drum in the main hoists. These hoists are driven by reversing asynchronous motors; the geared countershafts being connected to the drums by drag links from the original crank pins that were used when the hoists were run by steam power. The arrangement is shown in diagram in Fig. 14. Fig. 15 shows a large gear made for mining work.

In installations of this type there are no slipping clutches, and the strains on the gears are very severe, some of them having to transmit 3,000 to 4,000 h.p. at pitch line velocities ranging from 2,000 to 3,500 ft. per min.. The large coal mines in Northumberland, Yorkshire and South Wales are rapidly adopting high tension three phase current for the distribution of power below ground. Some very large main and tail, and endless, haulages are used in these, and herringbone gears have become a standard for this class of work. The hoists range from 30 h.p. up to 1,000 h.p., and invariably use a high reduction with ratios which are sometimes as great as 15 to 1. Simplification of design and saving of space is obtained in this way, since ordinary spurs require a double train. The gain in efficiency and absence of noise are remarkable, while the first cost of the whole outfit is often less than when cheaper gears are used. The elimination of all vibration prevents crystallization of the shafts and disintegration of the insulating material in the motors. These gears offer the same advantages for endless haulages. A higher speed motor can be used when they are adopted, while no more than two trains of gears are required.

An application of especial interest is for driving tipplers. These gears for this purpose have replaced worm gears because they stand up to the heavy strains without excessive wear. The available space for the gears is always limited in such cases. The gears have a ratio of 7 to 1 with a seven toothed pinion and a gear of only 20 in. diameter. Some typical high ratio gears are shown in Figs. 16 and 17.

**Elevators.**

There are very few high buildings in Europe and the elevators there run at comparatively low speeds. As a consequence, worm gears predominate for this class of work. The Wuest type of gear was brought out with a view to overcoming the losses inseparable from worm gears with high ratios. The needs of American sky-scrapers have caused the development of elevators in this country to run on different lines, so that the popular type of to-day has the rope sheave direct connected to the motor. Needless to say the motor runs at exceedingly slow speed, usually not more than 50 to 60 r.p.m. as a maximum. Such a motor is expensive and inefficient. The system of control is wasteful to a degree. Field regulation is out of the question, and the speed control is obtained by shunting the main current through a resistance so as to reduce the volts across the armature of the motor. The survival of so uneconomical a type of machine is due to there having been no satisfactory gear system which would fit the peculiar conditions. A number of elevators are now being equipped with herringbone gears. The motor is geared to the sheave through a single train with a ratio of about 10 to 1. The maximum motor speed is about 500 r.p.m. and the speed control is nearly all obtained by simple field regulation. The following advantages are claimed:—The power consumption is not more than 60 per cent. of what is required for direct connected motors, the electrical switchgear is far more simple, has less to do and is not so liable to get out of order; the motor can be repaired without interfering with the car or its suspension.

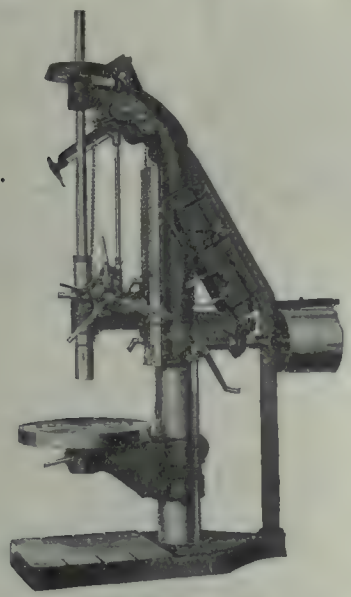
The Falk Company, Milwaukee, Wis., has acquired the sole rights for the United States under the Wuest patents and during the past year have been constructing some of the most powerful gear-cutting machinery in existence with a view to securing the required degree of accuracy in the production of gears of this type.

# DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

## ALL GEARED SLIDING HEAD DRILL

THE powerful 26-inch all geared, sliding head drill shown in the halftone has lately been put on the market by the Barnes Drill Co., Rockford, Ill.



All Geared Sliding Head Drill.

In its general lines it follows after the design of other all geared drills built by this firm, but has in addition a sliding head. The drill is belt driven from a line shaft, or may be had complete with motor drive if desired. There are eight geared speeds and eight geared feeds, the latter ranging from .005 inch to .086 inch. The head and spindle are counterbalanced, the weight being suspended by a roller bearing sheave. The spindle is extra large—1 15-16 inches diameter—and is double splined. The head is gibbed to the column face, insuring perfect alignment, and is held at any point of its 23-inch travel by two clamp screws. It is raised or lowered quickly and easily by means of a crank pinion engaging with a rack. This feature is advantageous for boring bar and deep hole work, for which the machine is well adapted. It will bore a hole 8 inches in diameter or larger, and is guaranteed to drive a 2-inch high speed twist drill in cast iron at a feed of .041 inch per revolution of spindle, without using the back gears. The spindle is bored to fit a No. 4 Morse taper shank, or may be had to fit No. 5, if specially ordered.

The fast and loose pulleys are 12x5 inches, and are run 325 r.p.m. The floor space occupied is 22x49 inches, exclusive of the pulleys which project 10 inches. The net weight of the machine is 1,750 pounds, or 1,950 pounds crated for domestic shipment. Further dimensions are given in the following table:—

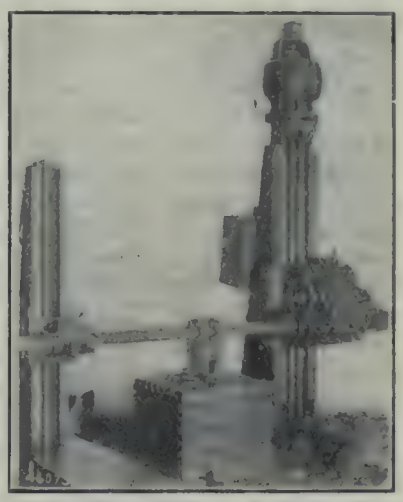
| | Inches |
|---|---|
| Height of Drill | 92½ |
| Distance from turned column to center of table | 13¼ |
| Distance from face of column to center of table | 12 |
| Diameter of column | 7½ |
| Diameter of table | 23 |
| Vertical travel of table | 20 |
| Vertical travel of spindle | 14 |
| Travel of sliding head | 23 |
| Greatest distance from spindle to base | 54 |
| Minimum distance from spindle to base | 18½ |
| Greatest distance from spindle to table | 40 |

## GRINDER WITH WHEEL GUARDS.

THE accompanying cut illustrates the No. 5 grinder fitted with wheel guards, recently brought out by the J. G. Blount Co., Everett, Mass. This is one of a line of seven grinders built by the firm designed to take wheels from 8 to 30 inches in diameter. The No. 5 grinder takes 16 inch wheels, 2½ inches thick, the arbor being 1¼ inches diameter. The bearings are babbitted and line reamed, the spindle being ground to fit. Bearings are made self-oiling by means of wool-felt wick. The pulleys are put on under pressure, thus doing away with the necessity for set screws which frequently work loose and cause more or less trouble. The wheel guards are made in seven sizes and can be fitted to any of the Blount grinders. They constitute a feature highly to be commended, and may be the means of preventing serious accidents. They are attached to the back of the head and are adjustable to allow for wear of the wheels.

Grinder with Wheel Guards.

The J. G. Blount Co. have recently got out a new catalogue of their grinding and polishing machinery, which gives full particulars of the machine here illustrated.



Vertical Motor Drive for Boring Machine.

## VERTICAL MOTOR DRIVE FOR BORING MACHINE.

PROGRESSIVE manufacturers are always cognisant of the importance of selecting an efficient drive for their machine tools. They readily perceive that the most direct or shortest distance between the source of power and the work, means not only more work with less power, but also reduced operating costs by eliminating many superfluous lines of shafting with belts to each machine, dripping oil, and the difficulty of speed changing. By the use of individual electric drive, the machines may be located in the most convenient places for the work they are to perform, rather

than in a row and driven from one line shaft. The economy and flexibility of individual motor drive cannot be too greatly emphasized, since this form of furnishing power has been largely responsible for the increased output of many varied industries.

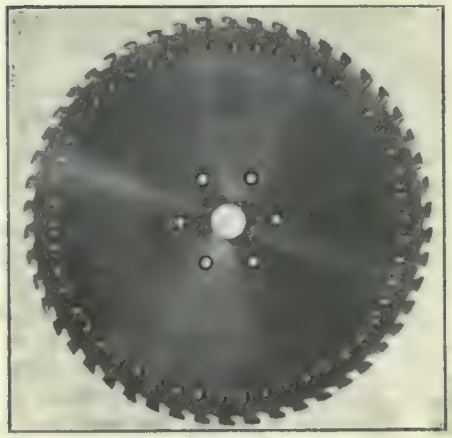
In the building of machine tools, another important factor, usually given careful consideration, is the saving of floor space. This opens a new field for electric motor by mounting directly on the top of the machine to be driven. The electric motor is ideal for this purpose and has found especial favor with machine tool manufacturers due to its adaptability to direct mounting. It matters little whether the motor be attached to a movable or stationary part, for the drive will be equally efficient.

High mounting also affords the operator plenty of space and at the same time keeps the motor remarkably free from dirt, chips and loose particles which often fall into it.

A particularly interesting and somewhat unique example of the manifold advantages of individual motor drive, applied to machine tools, is shown by the accompanying illustration. This horizontal boring machine is built by the Rochester Machine Tool Co., Rochester, N.Y. The motor is a 5 h.p., vertical type R, made by the Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa. The method of mounting the motor on the top of the column, as illustrated has proved particularly satisfactory in securing maximum efficiency, and it is surprising to us that motors of such small capacity should prove ample for the heavy work accomplished.

## DUPLEX INSERTED TOOTH SAW BLADE.

THE accompanying photograph shows the recently perfected Hunter Duplex Inserted Tooth Saw Blade, manufactured by the Hunter Saw & Machine Co., Pittsburg, Pa. This blade, designed for cutting forgings, steel castings, bars, rails, frogs, switches, etc., is manufactured in sizes ranging from 6 to 84 inches diameter, and of thickness most practical for the class of material to be handled. The blade body is made of the best grade of vanadium alloy tool steel, while the teeth, made of the finest grade of high speed steel obtainable for metal cutting, are properly hardened and treated. The teeth are secured by interchangeable tool steel wedges, lowered to brass adjusting screw. Roughing or round tooth is adjusted higher than finishing or flat tooth, so that a parting cut can be made, taking the remaining portion of material with the flat or finishing tooth.



Duplex Inserted Tooth Saw Blade.

Recent tests have been made with a 30-inch blade, wherein 1,275 cuts were made in 65½ hours on .61 carbon steel splice bars at a lateral feed of nine-sixteenths (9-16) inches per minute, bars being piled four high. A 40-inch blade, cutting .45 carbon round bars of hammered machinery steel, showed the following results, which are claimed to be a record for inserted tooth saw blade.

| | | | |
|---|---|---|---|
| 12 | in. | diameter | —5 minutes. |
| 9 | " | " | —3 minutes. |
| 6½ | " | " | —1 minute 30 secs. |
| 6 | " | " | —1 minute, 22 secs. |
| 5 | " | " | —1 minute. |
| 3½ | " | " | —25 seconds. |

## REMINGTON GRINDING ATTACHMENTS.

FIG. 1 shows an external grinding attachment for bench lathes designed with a view to securing the greatest degree of rigidity for grinding with half-inch face and 4-inch. diameter wheels. The grinding head may be removed and head for internal grinding substituted. The spindle for internal grinding is capable of speeds up to 30,000 r.p.m. The circular swivel base is graduated in degrees, to permit of tapers being ground. The lever movement is stantly carried away from, or returned to the work, greatly facilitating the fitting of gauges and placing of work. The emery wheel is covered, and is provided with an adjustable tube, to direct the flow of water, in wet grinding.

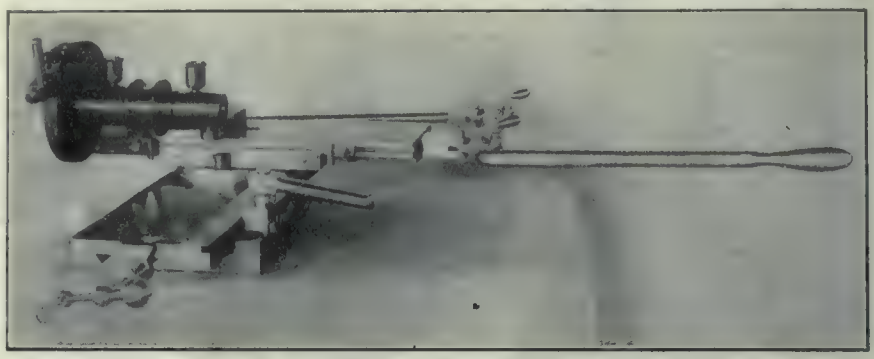


Fig. 1.—Remington Grinding Attachment.

Fig. 2 shows an external grinding attachment for bench lathe for grinding irregular forms without the necessity of resetting for different angles. It is particularly adapted for grinding hardened steel paper cutters. In the illustration is shown a paper cutter which has been ground on the plane, concave, and bevel, in one setting. Fine adjustments have been provided throughout, both for setting the wheel and to compensate for wear. The circular swivel base is graduated in degrees for setting wheel for varieties of work.

Both of the foregoing attachments are recent developments of the Remington Tool & Machine Co., of Boston, and are designed to be used with the manufacturer's bench lathe which they build.

Fig. 2.—Remington Grinding Attachment.

## THE WIGGLESWORTH BORING MACHINE.

THE Western Machine Tool Works of Holland, Mich., have recently placed on the market the Wigglesworth boring machine, especially adapted for the heaviest kind of boring, drilling and tapping. The machine is capable of handling 4-inch drills in steel, and of pulling an 8-inch pipe tap in cast iron.

In Figs. 1 and 2 may be seen the general features of this machine. As will be noted, the spindle remains in a fixed position, the head mechanism being fed down automatically on the column. The machine is equipped with nine changes of geared positive and independent feeds, ranging from 0.006 to 0.042 inch per revolution of the spindle, and three positive geared leads for tapping, 8, 11½ and 14 threads per inch. These tapping leads are independent of the 9 feed

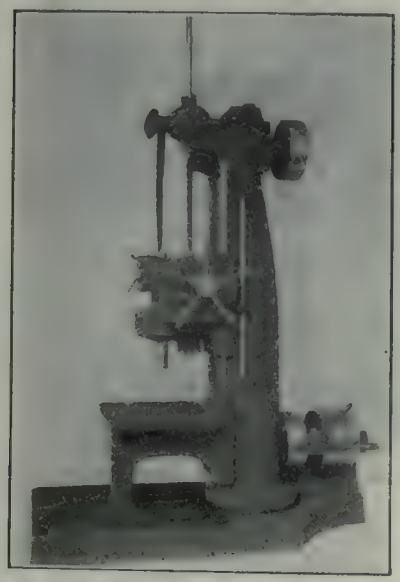


Fig. 2.—Wigglesworth Boring Machine.

changes. Any desired tapping leads may be obtained by means of other change gears, furnished as an extra.

As will be noted, a belted connection is made on this machine, between the countershaft on the base and the quick change speed gear box on the top of the column. The countershaft carries tight and loose pulley, 16x5 inches, and runs at a constant speed of 400 r.p.m. In the speed change gear box, eight different spindle speeds are obtained, which are doubled in the head by means of back gears, making 16 spindle speeds in all, ranging from 25 to 400 r.p.m. From the gear box, the power is transmitted to the head proper through a set of three bevel gears and a friction clutch, which form the reverse mechanism for tapping. The long lever for operating this friction clutch is located conveniently on the left hand side of the head as shown in Fig. 1.

In the head, the spindle is driven by a large gear located in a fixed position, at the lower end of the spindle close down to the work. This arrangement reduces the torsional strains on the spindle and stiffens it, thus reducing the chatter usually present when taking heavy cuts.

The automatic down feed to the head on the column is driven from a spiral gear located near the upper end of the spindle. From here it goes through the quick change feed gears to a spur gear which meshes with a rack cut in the face of the column. It will be noted that this arrangement necessitates the feed operating strictly in conjunction with the spindle movements, and that the spindle does not move down through the head, but that the whole head moves down carrying the spindle with it.

The design of this machine is of the most improved type, and is extremely rugged and rigid throughout, although as compact as possible. The construction of the column is of especial interest. It will be noted that the cross sectional area of the column increases from the top downwards. This is because, as the head is raised, the bending stresses at the base of the column are increased, necessitating a greater cross sectional area at the base of the column than higher up.

In the old-style turned columns not only has the strength and rigidity been sacrificed by turning off the cast iron scale, but due to the equal cross sectional area along the entire length, the lower part of the column is too weak and the upper part carries an excess of metal which is useless as far as lending strength or stiffness is concerned. This has been proved by a number of tests on the two types of columns under exactly the same working conditions. The bending in the new type of column was less than 1-3 of that in the turned type.

As stated above, the machine is especially adopted for tapping. By means of the long lever on the left of the machine, the tap may be fed down with a geared positive lead, reversed and positively fed out. This obviates the old trouble of the tap dragging when being backed out and thus roughing up the threads. The result is a fine, clear tapping job. It should be noted that the spindle receives its motion from a low hung drive, i.e., the motion is imparted to the spindle by a gear placed close down on its lower end near the work. As the head moves down the driving gear remains at a fixed distance from the tool because the head itself moves down on the column carrying the spindle with it.

On the under side of the table, below the centre of spindle, a hub is bored out and heavily ribbed on the outer edges. Thus, when a boring operation, like an open end cylinder job, is to be performed, all that is necessary is to drill and bore out a hole through the table into this hub and insert a bushing. The boring bar can be run through and steadied in this bearing. In this manner a support to both ends of the boring bar is obtained, the great advantage of which can be readily seen. The cutter will feed down through the work with an accuracy of alignment and freedom from spring and chatter that is obtainable in no other way.

The lubrication of this machine is automatic throughout. All gears in the head and quick change gear box are steel or bronze and dip in a bath of oil, the head alone holding seven gallons of lubricant. The bearings are made self-oiling by laying a wick in a slot milled out of the bearing, the ends of the wick dipping

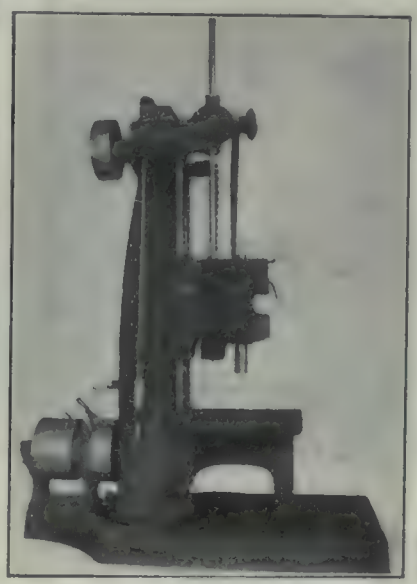


Fig. 1.—Wigglesworth Boring Machine.

into a reservoir of oil. The same is true of the loose pulley on the countershaft, where the ends of the wick dip into a reservoir cored out of the hub. These reservoirs hold enough oil to last for several months with the machine in constant service.

Regarding the general specifications of this machine, there are regularly furnished three positive geared leads for tapping, 8, 11½ and 14 threads per inch. There are also 9 geared positive and independent feeds to the spindle ranging ing from 0.006 to 0.042 inch per revolution of the spindle; the automatic down feed to the head on the column is 40 inches, the distance from the face of the centre of the spindle is 14½ inches, the diameter of the column front to back is 18 inches, and the size of base 40x90 inches. The machine weighs about 8,500 pounds.

When motor drive is desired, all that is necessary is to place a motor on the

base back of the column, in place of the countershaft. The Wigglesworth boring machine may be seen in operation by a visit to one of the demonstration shops of Hill, Clarke & Co., Inc., of Boston and Chicago, and their branch offices at New York, Philadelphia, Cleveland, Milwaukee and Rochester.

## UNIVERSAL SPIRAL GEAR HOBBER.

THE Adams Co., Dubuque, Iowa, has added to their line of Gear Hobbing Machines a No. 4, adapted to cut spur, spiral, worm wheels and worms, up to 24 inches diameter, 3 pitch in cast iron, and 3½ pitch in steel. This machine is capable of such a wide range of feeds and table speeds as to make it universal. It can be arranged, and change gears furnished to cut a single thread worm or screw of fine pitch, and from that, on up through all pitches and number of teeth of worm, spiral and spur gears, including all prime numbers up to a thousand or more. The vertical feeds of the cutter head range from .002 to .500 inch for one revolution of the table. The table may be geared to make one revolution to two revolutions of the cutter, or it may be geared to make one revolution to a thousand or more revolutions of the cutter. This range of feeds and table speeds is, of course, unnecessary for ordinary spur, spiral and worm gearing, yet no additional complication has been introduced to obtain it. The design of the drive of the table and feeds is such that the compounding of a comparatively small number of moderate size gears enables this range to be had.

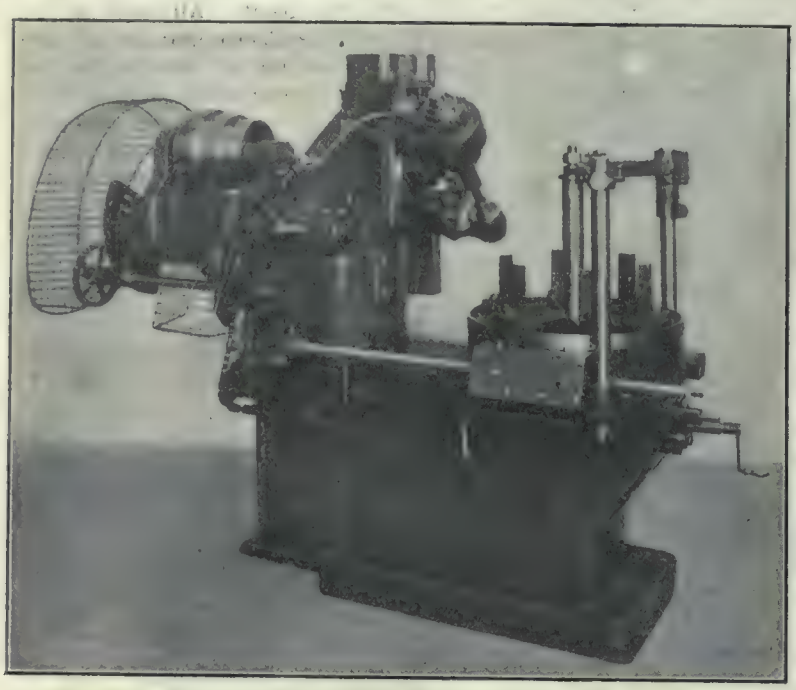


Fig. 1.—Universal Spiral Gear Hobber.

The machine is especially designed for gear and worm hobbing, but the slow table travel obtainable, relative to the cutter speed, enables the machine to be used also as a continuous or circular milling machine. A special spindle and bracket such as shown in Fig. 4 may be had for this purpose. Unusual weight and width of saddle and swivel is provided to increase the rigidity to the greatest extent. The cutter spindle is large and has a hole through which the arbor proper passes and is driven by a long key and feather. Adjusting nuts on the arbor at each end of the spindle provides for an end adjustment of the hob to facilitate setting one tooth central and to shift to fresh cutting position. The spindle is driven by a steel spur gear and pinion, and both spindle and pinion shaft run in adjustable bronze bearings on each side of the gears, thus equalizing the strain.

Fig. 3.—Universal Spiral Gear Hobber.

There is but one pair of bevel gears in the spindle drive train, two pairs less

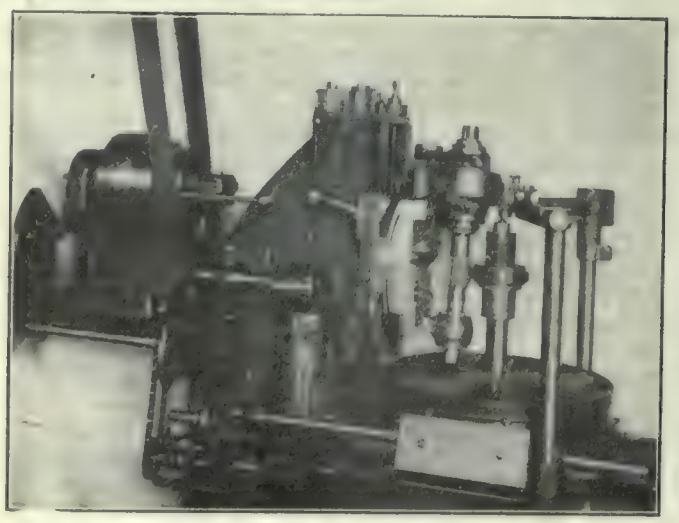


Fig. 2.—Universal Spiral Gear Hobber.

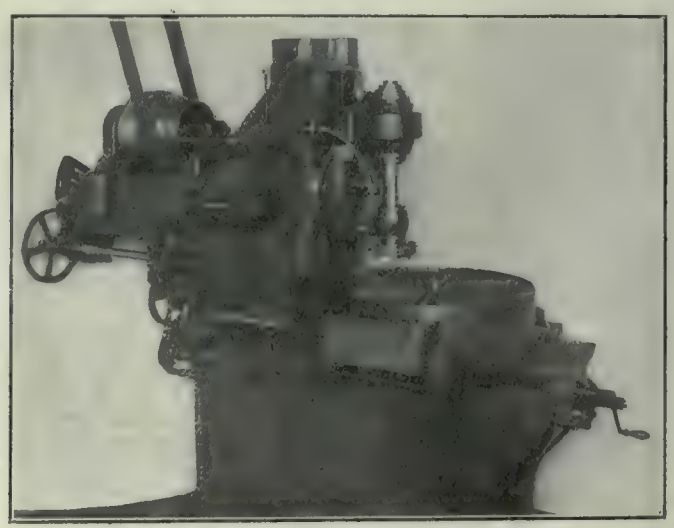


Fig. 4.—Universal Spiral Gear Hobber.

than usually found in swivel head construction. There is no long spliced shaft and sliding key used in the drive.

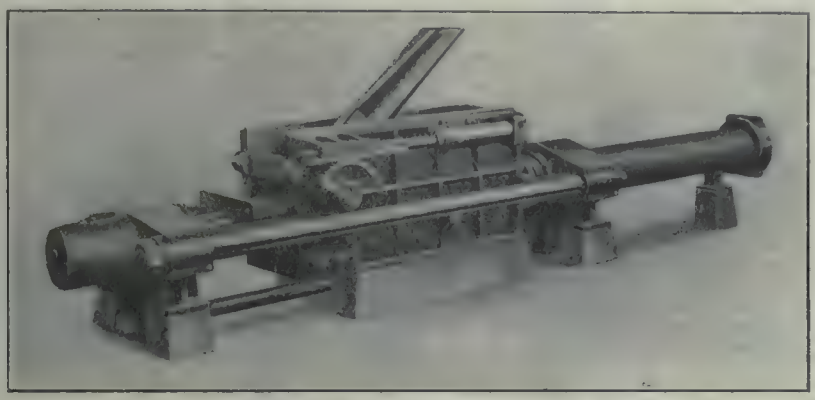
A reducing gear of large diameter is interposed between the cone pulley shaft and a universal joint shaft which communicates power to the spindle. This is the same drive which has been found so satisfactory in the No. 3 machine. The universal joints, of special design and very strong, are provided with large wearing surfaces of steel on bronze. They have ready means to compensate for wear, and are equipped with felt oil retaining pads to facilitate lubrication. The cutter head has a vertical power feed ranging from two thousandths to one-half inch to each revolution of the table. An automatic stop and a rapid power return is provided. The table saddle has a power inward feed ranging from one quarter thousandth to three-eighths inch to each revolution of table, and an automatic depth stop is provided for worm wheel hobbing.

A regular set of change gears, 120 in number, will give all feeds, and will cut all gears to 200 and many composite numbers above. Special gears can be furnished to cut other numbers including all prime numbers. The countershaft furnished is provided with three clutch pulleys; being a hobbing speed in both directions and a slow speed for driving milling cutters such as shown in Fig. 4.

The lubricating pump is arranged to run in the right direction when the motion of spindle is reversed. The table is driven by a steel worm engaging a bronze ring worm wheel. This worm wheel is 20 inches diameter in the 24-inch machine. Provision is made for easily taking up wear either in the mesh or end motion of the worm. The table is of heavy rib or spoke and rim construction, but the top between the ribs, instead of being level, is depressed in a cone shape with a hole in the centre. This conducts all cuttings and lubricant into a pan in the base of the machine. The lubricant drains out of the pan into a tank below. This pan may be easily removed through the door and contents dumped, handles being provided for the purpose. The weight of the machine complete is about 3,900 lbs.

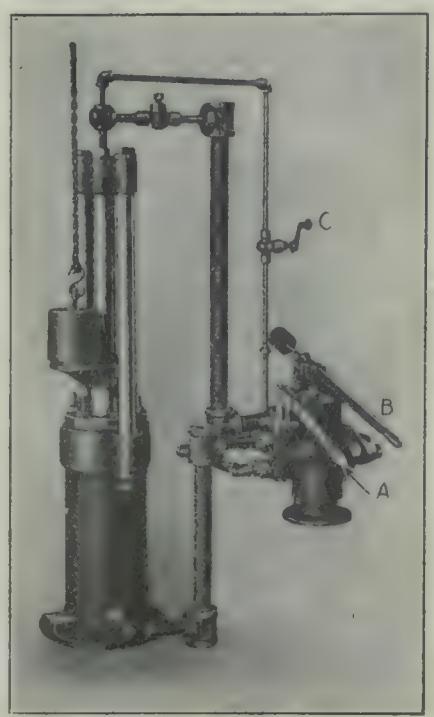
## BALING SCRAP SHEET METAL BY HYDRAULIC POWER.

SCRAP from sheet iron, such as is used in the manufacture of electric motors can be made worth something like $6.00 per ton more by compressing into bales, because of the labor saved in handling the latter; hence, delivery in baled form warrants the installation of baling apparatus in any plant where there is much of this material.



Sheet Steel Scrap Baling Press.—200 Tons.

The illustrations show a type of press and its operating system recently designed for this purpose by The Watson-Stillman Co., of New York, and installed by the General Electric Co. This particular type of press takes scrap from the floor, compresses the material, pushes the bale out and drops it beneath the floor on to a runway. From the end of this runway the bale can be dumped on to an elevator from which, in turn, it can be put on to another runway and delivered to a freight car. With suitable pump and accumulator service, this press forms from 15 to 25 bales (about 2 to 3 tons of material) per hour, the output depending upon the skill of the operator.




Safety Governor.

The press, approximately 23 feet long, 4½ feet wide, 4¼ feet deep, is set in a pit about 6 feet deep and 30 feet long and rests on pedestals to give room for repairs if necessary. The working parts consist of (1)—a scrap or pressing box, the top of which is flush with the operating floor line, and which has hydraulically operated cover, and, (2)—two opposed hydraulic cylinders. One of these closes the box and the other compresses the bale and pushes it out. The pressing box is 60 inches long by 20 inches wide by 30 inches deep, which depth is reduced to 10 inches by the closing of the cover. The larger of the cylinders (at the left in the picture) closes the front end of the press, at the same time acting as a lock to the cover when it is closed, and is controlled by the same valve as the main or compressing cylinder (at the right). The compressing cylinder is double acting.

Pressure is supplied to the closing cylinder and the working end of the compressing cylinder from a variable pressure belted hydraulic pump. This pump has large pistons which deliver up to 1,500 lbs. per square inch, and are automatically cut out of action by the smaller ones as the pressure goes above the figure named, and continue in operation until a maximum of 4,900 lbs. per sq. in. is reached. At the instant of highest compression, the pump has a maximum duty of about 40 h.p. Pressure for the cover-closing cylinder and for pulling back the ram of the compression cylinder is furnished at 1,500 lbs. per sq. in. from an accumulator, served by a separate small pump, and loaded with about 15 tons of pig iron.

### Service Operation.

In service, the action is as follows:—About 250 lbs. of material are shovelled into the box and the valve A is moved This admits accumulator pressure to the cover cylinder, forces its ram outward and closes the cover through the rack and pinion. One movement of the valve B then puts pump service simultaneously upon both closing and compressing cylinders. This first sends the ram of the closing cylinder forward until at the limit of travel it locks the box cover into closed position; then as pump pressure in the outer end of the compressing

cylinder goes above and overcomes the accumulator pressure in the pull-back end of the cylinder, the compressing ram moves forward until the pump pressure reaches the maximum of 4,900 lbs. per square inch. The parts are so proportioned that this gives a total finishing pressure of 200 tons upon the bale, which reduces its dimensions to about 20 inches by 10 inches by 10 inches, and makes it so compact that no straps are required.

A second movement of the valve B releases the forward pressure in the closing cylinder, thus permitting the compressing cylinder ram to continue pushing the bales to the left and out of the press and at the same time returning the closing cylinder ram to initial position. A third and final movement of the valve B then releases the forward pressure on the compressing cylinder ram, the bale drops down into the delivery chute, and the accumulator pressure which has been constantly acting on the return end of the compressing cylinder ram brings this latter back to initial position.

### Governor Protection.

Protection from harmful overpressure is provided in the safety governor (shown at the left in the second illustration) which shuts off the pump at the limiting pressure. This governor has two cylinders with pistons of different diameters, the larger at the bottom and in direct contact with the accumulator pressure, 1,500 lbs. per sq. in. The smaller is direct-connected to the discharge pipe of the large automatic variable pump. The accumulator pressure being constant on the larger piston, the shelf supporting the weight is normally in its highest position. With the weight here, the pump discharges through the large operating valve either to the press cylinders, or back to the reservoir. When the valve is set for admission to the press cylinders, pressure in the top part of the governor is gradually increased. As the bale compresses, the low pressure plungers are first thrown out automatically, after which the two high pressure pistons continue the work until the maximum pressure of 4,900 lbs. per sq. in. is reached. When this happens, the 4,900 lbs. pressure also acting in the top or small cylinder of the governor, overcomes the pressure in the other end, forces the piston with the shelf downward, releases the weight and causes the high pressure plungers of the pumps to be by-passed. By opening the small valve C, shown in the vertical pipe line, the pump is started again.

Where desirable to deliver the finished bale on to the operating floor, a three-cylinder construction is necessary, the extra cylinder being placed vertically under the bale, and the upper end forming the bottom of the baling box. The dimensions and operating plan of such a system can, of course, be varied to comply with any service conditions.

## BLOWERS FOR OIL FURNACES.

THE blowers for oil furnaces in connection with the N.T.R. shops, Transcona, Winnipeg, were specially designed by the Canadian Buffalo Forge Co., Montreal. The blower installation in itself is of considerable interest.

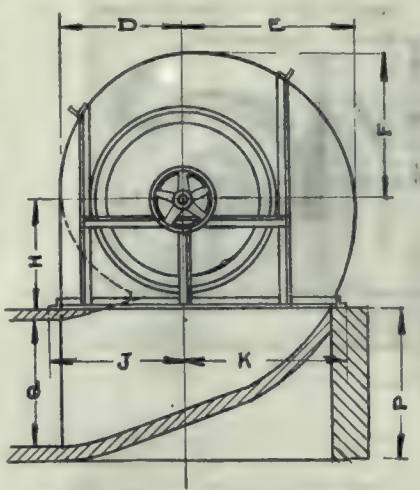



Fig. 1.—Blowers for Oil Furnaces.

The fan for the boiler shop consists of a No. 12 steel pressure blower, with down discharge, connecting to the underground distributing pipe, which is placed 13 inches below the floor level. From the outlet of the blower, a large sweep elbow is thus allowed. The larger blast pipe, increasing from 18 to 24 inches diameter, not only provides for future extension in case it is found necessary but also regularly reduces the friction which is inevitably incurred wherever it is attempted to force air through piping at a high velocity. This blower is designed to deliver 10,000 cubic feet of air per minute, at a pressure of 16 oz. when running at 1,750 r.p.m., and is direct connected with flexible coupling to a 75 h.p. Allis-Chalmers-Bullock Co. motor. A special feature of the whole installation is the fact that the blowers are, for all the large groups, direct connected to motors, thus eliminating belts and the constant repairs necessary where the alternative method of countershaft and belting is employed.

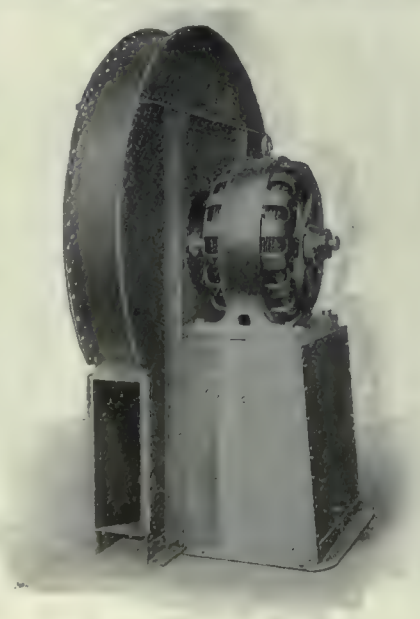


Fig. 2.—Blowers for Oil Furnaces.

In the blacksmiths' shop, the air blast is divided into two separate systems, one being supplied by another No. 12 steel pressure blower of exactly the same design as the one described above for use in the boiler shop. The other outfit consists of a Canadian Buffalo Forge Co. special steel plate blower, to deliver 6,400 cubic feet of air per minute at 14 oz. pressure and 1,750 r.p.m. This is direct connected to a 50 h.p. Allis-Chalmers-Bullock Co. motor.

In the spring shop there is a similar blower, slightly smaller in size, to deliver 4,800 cubic feet of air per minute, at 14 oz. pressure and 1,750 r.p.m., direct connected to a 40 h.p. motor. In the frog shop there is one No. 5 Buffalo special steel plate blower to deliver 2,700 cubic feet of air per minute at 1,750 r.p.m., direct connected to a 25 h.p. motor.

The steel plate blowers on this installation are specially interesting, due to the fact that they are built of the three-quarter housing type, Fig. 1, which means that the lower quarter of the fan is below ground. Further, the fans are of the bottom horizontal discharge construction, so that the outlet is also below the ground, and directly in line with the blast pipe, eliminating at least two elbows and giving a free positive flow of air direct from the paddles of the fan blast wheel.

A further special feature is the construction of blowers of this type for delivery of air at such a high pressure as 14 oz., and with a speed so low as 1,750 r.p.m. The standard blower, supplying 2,700 cubic feet of air per minute at 14 oz. pressure, would need to operate at a speed of approximately 4,000 r.p.m. The desired results are secured by the use of a special narrow housing, Fig. 2, with blast wheel of large diameter, and having a larger number of blades than in the ordinary design.

In connection with the furnaces in the coppersmith shop and for coal burning forges, there are three other blowers of the standard steel pressure type operating at 6 oz. pressure.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. VIII. MARCH, 1912 No. 3


## MUSEUMS OF SAFETY.

NOT the least important feature of the upward and onward progress of the Arts and Manufactures is that which has found concrete expression in the establishment of Museums of Safety in many leading commercial cities throughout the world. The present attainment has been a work of 25 years practical application, yet the efforts put forth have not only justified themselves but warrant the belief that an era of much more rapid development and increased usefulness lies ahead in this important field.

To enable our readers to get a thorough grasp of what is embraced by the term, "Museum of Safety," we reproduce in part a memo from the constitution of the American Museum of Safety, Incorp.:—"The objects of the corporation hereby created are to study and promote means and methods of safety and sanitation; the application thereof to any and all public or private occupations whatsoever; the advancement of knowledge of kindred subjects, and to that end to establish and maintain a museum, library and laboratories, with their branches, wherein all matters, methods and means for improving the general condition of the people as to their safety and health may be studied, tested and promoted, with a view to lessening the number of casualties, avoiding the causes of physical suffering and of premature death, and to disseminate the results of such study, researches and test by lectures, exhibitions and publications."

From the foregoing, it will be at once seen that the ideal aimed at is intensely practical and humane, and, being so, cannot fail to interest and commend itself to everyone connected with our large and small industrial organizations. These Museums of Safety are absolutely non-commercial, therefore, no orders are taken, no exhibits are sold, and the management takes no part in the promotion of devices. In a majority of cases, the exhibits are not patented, hence, those desirous of availing themselves of the opportunity to produce a duplicate for service, may do so. Space for an exhibit, also spectator's admission are each free, and demonstration costs are borne by the Museum Management. No exhibit is accepted unless a safety feature is apparent, and has been passed upon by the Board of Approval.

The value of such institutions, the scope of which we have outlined in the briefest possible manner, is inestimable. Men from all departments of manufacturing industries are to be found visiting these Museums, investigating details of the various contrivances shown, discussing the possible application of one or other to their particular business, and making dimensioned sketches to enable an equipment to be made and placed in operation to husband and protect life to the fullest extent possible.

The extent and scope of Canada's development in almost every field of manufacture warrants we believe the establishment in each of our leading industrial centres of a "Museum of Safety," and we feel justified in expressing the opinion that those responsible for the direction and management of our many large industrial corporations will not be lacking with a ready response. No more effective contribution to "higher efficiency" and none so easily realizable is evident than that of employees inspired with confidence in the efforts put forth to safeguard their health and lives, and it goes without saying, that to no other scheme of business management, is there the same hearty and willing co-operation extended. The instinct of self preservation is more or less strong in every type of human being, and best feature of all, perhaps, is that it reaches out equally strong to a man's fellow.

## THE STEEL RAIL CONTROVERSY.

THERE was recently inaugurated in New York City a much needed conference between representatives of railroads and steel mills with the object of arriving at an agreement as to what constitutes a safe rail and to consider the whole subject of improving the character and quality of rails generally. For the last fifteen or twenty years the mills have been called upon to supply rails having an ever increasing carbon-content and have delivered same, though not without protest. This demand commenced about the year 1890, and of course, had for its object the reduction of rail wear caused by increasing traffic. Gradually, the railroads specified higher and higher carbon, until the alarming number of fatal accidents due to broken rails has called a halt, and brought to a head the controversy between the users and the makers.

We feel sure the conference will be productive of much good. The roads have, perhaps, been too much inclined in the past to place economy before safety, and it seems clear that they must in future be prepared to use a somewhat softer and less brittle rail, but one of somewhat heavier section in order that it may have as long a life as its high-carbon predecessor. This is the remedy for the present state of affairs suggested by Mr. James A. Farrel, president of the U. S. Steel Corporation, when recently giving testimony before the Stanley investigating committee at Washington, and appears to us to be the only satisfactory solution of the difficulty.

# MACHINE SHOP METHODS AND DEVICES

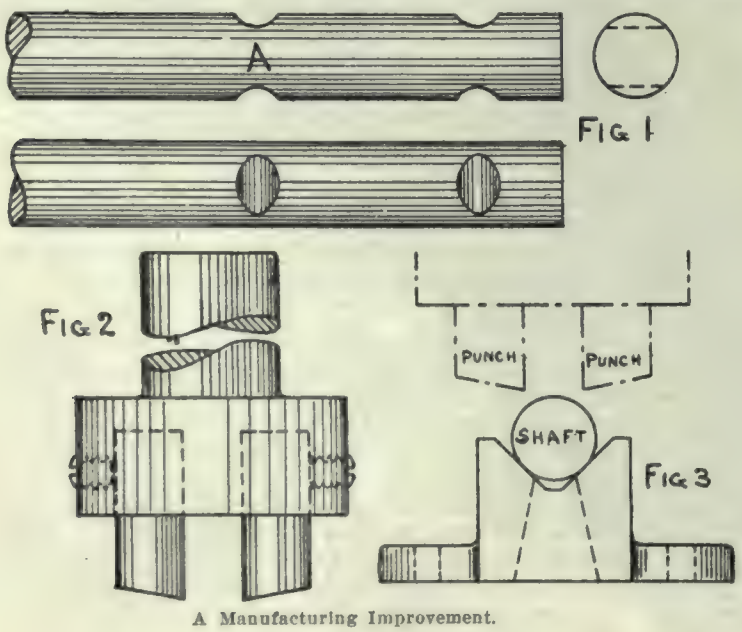
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

## A MANUFACTURING IMPROVEMENT.

By Donald A. Hampson.

THE shaft shown by three views in Fig. 1 and forming one of the parts of a certain special machine, has near one end a pair of notches cut for driving purposes. Each notch is double, making a total of four cuts. While their size, spacing and finish are within easy limits, a good deep notch is required, and at a low cost. The shafts are made from Jessop's carbon steel and to form the notches we tried both milling and grinding; either process, however, took considerable time when a thousand or more pieces had to be put through. We naturally were ready to consider any method that promised improvement. The suggestion was made that the notches be punched; and as we had an idle punch press, it was decided to rig it up; the cost of the tools not seeming excessive. A punch-holder was turned up from a piece of mild steel, and in the body two ½-inch holes were drilled and squared out for the punches. The latter were made from ½-inch drill rod and were secured in place by set screws, as shown in Fig. 2. A modified form of vee block served as a guide and support for the shaft while being punched, as may be clearly seen from Fig. 3. Lugs were provided for bolting down purposes, and directly under the punches the casting was cut to clear the latter and to give chip room. A slot was also cut in the middle of the block and a hardened steel piece inserted of the same shape as the rest of the vee, thus practically eliminating wear at this point.

For turning out the work quickly this outfit was the best we had tried—so good in fact that it was marked "Final." The punches had to be set so that both would strike at the same time, no clamp for the shaft being then necessary. The shafts, which were ⅝ inch in diameter, were pushed in against a stop and a stroke of the press formed notches A. They were then pulled forward until one of these notches engaged a latch held by a light spring, and a press on the treadle started the second stroke. The whole thing was as simple as could be, and required no changes to overcome initial defects. Punches were made up a dozen or two at a time, and seldom cost more than a dollar per thousand shafts notched. As will be observed, they are short and stiff, this being effected by keeping the clearance between the shaft and the punch holder as small as is practicable.

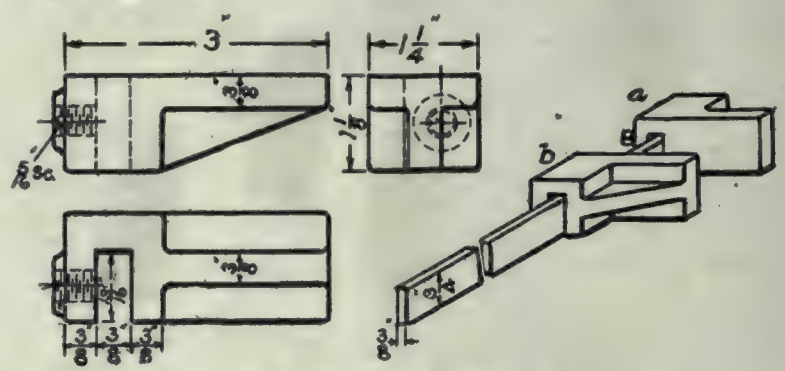



A Manufacturing Improvement.

## A HANDY WORK HOLDER.

By J. E. Cooley.

ONE of the problems often met in connection with a drill press is a simple and quick method of holding work to be drilled, such as jig bodies, blocks, caps, etc. It often happens that there is no wrench handy that opens wide enough to take in the required piece, and the leverage from the handle of an ordinary wrench when resting against a stop is so short that drills are easily sprung. To overcome this difficulty, the device here shown was designed and will hold work of any width. The handle is 36 inches long, and when the end is placed against a stop, gives a powerful leverage, at the same time allowing the work to float and thus prevent the drill from being sprung. It consists of two cast iron jaws, "a" and "b," sliding on a piece of ⅜ x ¾ inch stock, and fastened by 5-16 inch set screws. The jaw, "a," can remain stationary and adjustment be made by jaw "b." The castings are, of course, made right and left handed.



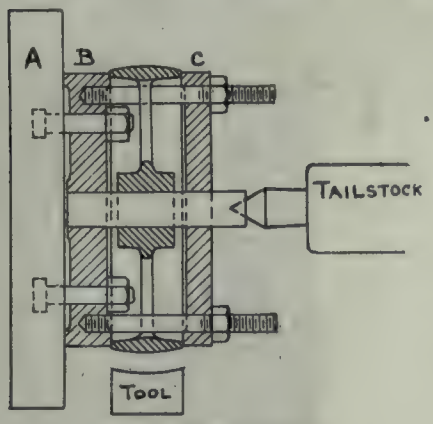

A Handy Work Holder.

## RAPID PULLEY TURNING.

By J. H. W.

THE accompanying cut illustrates the method employed by A. B. Jardine & Co., Hespeler, Ont., for turning straight and crown-faced pulleys where the width does not exceed 4 inches. The hub is first faced and bored, and both edges of the rim are then faced true and square. Referring to the cut, A is the face-plate of an engine lathe to which a cast-iron plate, B, is attached by means

of T-headed bolts. This plate is bored out for a 1 3-16-inch mandrel, the outer end of which is supported by the tail-stock centre. The pulley is mounted on the mandrel, a sleeve being used if the bore of the hub exceeds 1 3-16 inches. It is then securely clamped to the plate B by means of the outer plate, C, and by




Rapid Pulley Turning.

long studs passing between the spokes. A flat profile tool, ground to the desired curvature and of the exact width of the pulley, is clamped to the slide rest and the job is then quickly put through. The time taken to turn a pulley 10 inches diameter by 2½ inches face is only four minutes.

The great advantage of this method of mounting the pulley is the high degree of rigidity secured, which enables a heavy cut to be taken. For this reason, the method is commonly employed by this firm, even when the pulley is too wide to admit of the use of a profile tool.

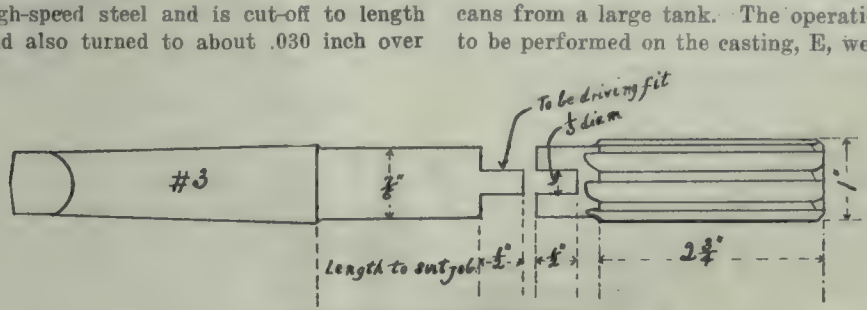
Standard plates and tools are kept on hand to suit various diameters and widths, and since their introduction a large saving of time has been effected.

## ECONOMY IN HIGH-SPEED STEEL.

By E. Bates.

HEREWITH is shown one method of reducing the cost of making high-speed reamers, rose-bits, etc. The shank is made of machinery steel and rough turned to about .030 inch over size, the ends being milled as shown in the cut. The cutting portion of the reamer is of high-speed steel and is cut-off to length and also turned to about .030 inch over size. It is then put in the milling machine to be grooved and have the slot for the tongue on the shank cut. The width of this tongue is one-third the diameter of the shank and it is made a driving fit in the slot. The two parts having been assembled they are taken to a gas furnace and there brazed with copper wire, borax being used as a flux. When the correct brazing temperature has been reached, the tool is partly withdrawn from the furnace so that the joint cools, while the point reaches a hardening heat. It is then plunged into an oil bath, after which it is ready for grinding to size.

I have found that machining takes no longer by this method, as the shank is turned very much faster than when of high-speed steel; also the brazing and hardening take very little longer than when hardening an ordinary rose-bit. The amount of high-speed steel saved by this system of manufacture is quite a consideration where many rose-bits are used, especially if they are long ones. Moreover, it gives opportunities for using up short pieces that would otherwise be scrapped.



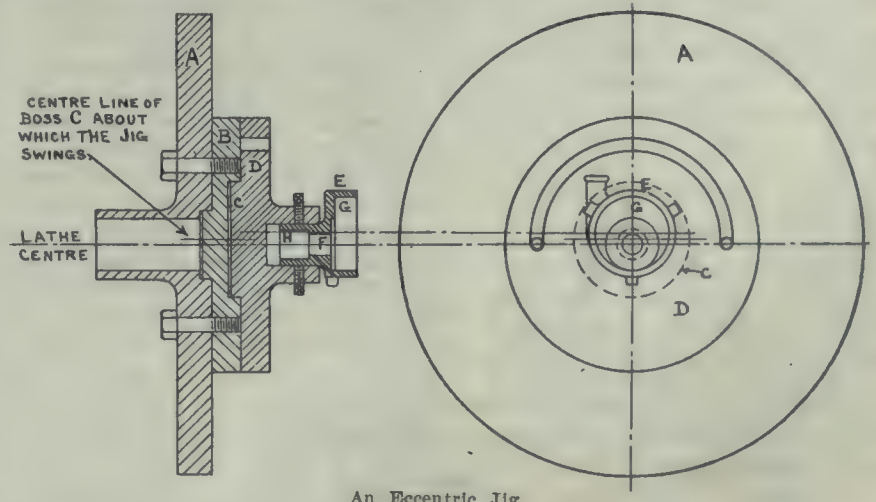

Economy in High Speed Steel.

## AN ECCENTRIC JIG.

By John E. Davies.

THE following is a description of a jig designed by W. Moore and used by W. & J. G. Greey, Toronto, in boring and turning the casings of small centrifugal pumps designed for filling paint cans from a large tank. The operations to be performed on the casting, E, were: (1) to bore and counterbore the neck at F, and, (2) to bore and turn the inside of the shell G, which is eccentric with F. Before designing this jig, the job, of course, had to be set twice and we experienced considerable difficulty in keeping the faces in the same plane and in getting the same amount of eccentricity on each piece. However, the jig overcame all our troubles and enabled us to make a good job, every piece being alike. Moreover, the total time of setting up the work was reduced to 1½ minutes.

Referring to the drawing, A is the lathe face plate, which was first trued up and counterbored at centre. B is a cast-iron plate turned and fitted into the face plate as shown, and secured by cap screws and dowel pins. On the face of B, and eccentric with it, is a recess; the amount of its eccentricity being exactly half that of the job to be bored. The jig D is concentric with B but has a circular eccentric projection C which fits the aforementioned recess in face of B. The casting D is held in place by two cap screws, located at the ends of a semi-circular slot which allows the plate to be swung round through exactly half a circle when one of the cap screws is removed. Having set the work by means of four set screws, the neck F is first bored and counterbored. The cap




An Eccentric Jig.

screws securing D are then loosened and one removed, the plate then being swung through half a revolution, thus bringing the centre of the shell G in line with the lathe centre. The nose of the chuck is turned the same size as the bore of G, so that for the third operation, viz: boring and threading for a gland nut at H, the casting is simply turned round, placed on the nose of the chuck and secured by a yoke and two bolts. The plate D is then swung back to its original posi-

tion bringing F once more central with the lathe spindle.

The semi-circular slot in D is, of course, not struck from the centre of plate D, but from the centre of the projection C on the back of it.

## CUTTING KEYWAYS ON LATHE CHUCK WORK.

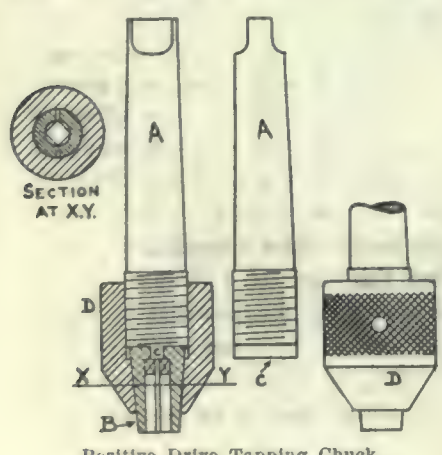
By F. Cotton.

HAVING occasion to cut keyways in some chuck work and having nothing but a lathe on which to do the job, I put a 24-inch pulley on my main line-shaft and connected it by a 1½-inch belt to the core pulley on the end of the thread-cutting gear spindle. I then chucked the work and blocked the chuck to prevent it from turning. Having clamped the tool in the tool post, I next closed the nut on the lead screw, running the carriage back by hand after each cut. In this way I cut a 1-inch by 6-inch keyway in 40 minutes.

## A POSITIVE DRIVE TAPPING CHUCK.

By John E. Davies.

THIS positive drive chuck consists of three pieces only, and was designed especially for tapping nuts or any hole passing right through the work. For tapping blind holes, a friction drive is perhaps preferable, since there is then less chance of breaking the tap if the latter is carelessly allowed to reach the bottom of the hole. The illustration clearly shows the construction of the chuck. A is the shank turned to a standard Morse taper and having at its lower end (below the threaded portion) a driving tongue, C, which fits into a corresponding slot in the collet, B. This collet is of hardened steel bored out and squared at the top to take the tap. It is sawn completely through on one side and partly through on the other, to enable it to take a firm grip of the tap when the chuck is tightened up; this is shown in the section on X.Y. D is a round knurled nut threaded to fit the shank and bored out taper at its lower end to fit the outside of the collet. When the tap is inserted, a slight turn of this nut suffices to lock it securely, holes being provided in the periphery of the nut for the insertion of a locking bar.



Positive Drive Tapping Chuck.

To accommodate different sizes of taps a complete set of collets is provided, each one being bored and squared to fit its own tap, but all having the same diameter and taper on the outside.

## WATCH THE LABEL ON YOUR PAPER.

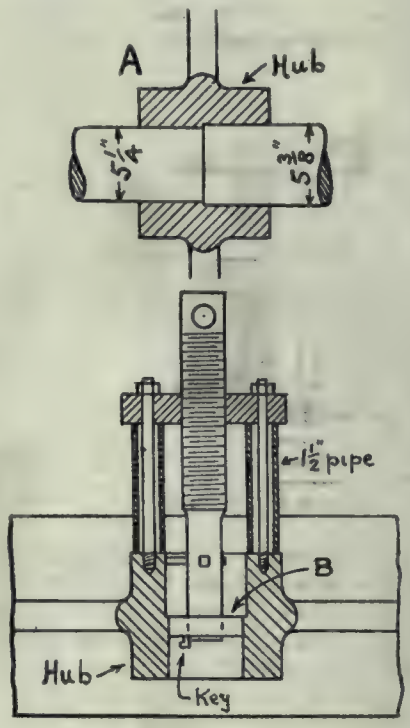
So heavy has become the work in the subscription and circulation departments of our various papers that we are unable adequately to keep up with the work of sending receipts to all subscribers for subscriptions received. Some time ago, because of this congestion, we were forced to select a new plan with our trade papers by notifying our readers who sent in money for subscriptions to watch the address label of their paper and see that the date of expiry of subscription was changed. This plan has worked well with the papers which adopted the scheme, the changing of the date being sufficient notification to the subscriber that his subscription had been received.

In future, instead of sending out receipts for money paid on subscriptions we will simply change the expiry date on the paper going to the subscriber. If your paper does not have the label changed on the next or following issue after payment of subscription, drop us a post card and the error will be rectified immediately. Watch the label on your paper.—The Canadian Machinery.

## REBORING A LARGE PULLEY.

By F. Cotton.

HAVING to rebore a pulley 6 feet in diameter to fit two different sizes of shafting as shown in the sketch at A, and there being no lathe large enough for the job, I rigged up a boring tool in the following manner. With the pulley lying flat on the floor, I first tapped into the hub four ¾-inch studs, 10 inches long, and over these I placed pieces of 1½-inch wrought iron pipe. These supported a circular plate 2 inches thick, having at its centre a hole tapped out to 3 inches diameter, 16 threads per inch. To fit this hole I turned and threaded a boring bar as shown in the sketch. I next turned up a piece B, 5¼ inches diameter to fit the bore of the pulley, and keyed this to the end of the boring bar to act as a guide. The tool was made of ½-inch square self-hardening steel and



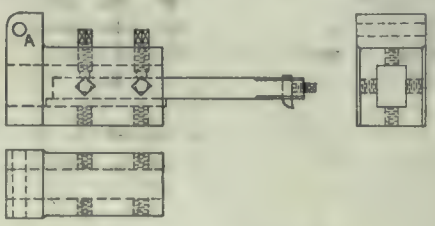
Reboring a Large Pulley.

the bar was revolved by a pinch bar inserted in a 1⅜-inch hole near the top. By these means I managed to complete the job in eight hours.

## SPECIAL SHAPER TOOL BOX.

By A. E. W.

THE tool box here shown is intended to take the place of the usual cranked tool bar when doing such work as keyseating a gear wheel on a shaper or planing a job that will not pass under the crossbar of the planing machine. It consists of a grey iron casting in which the tool bar is clamped by set screws,



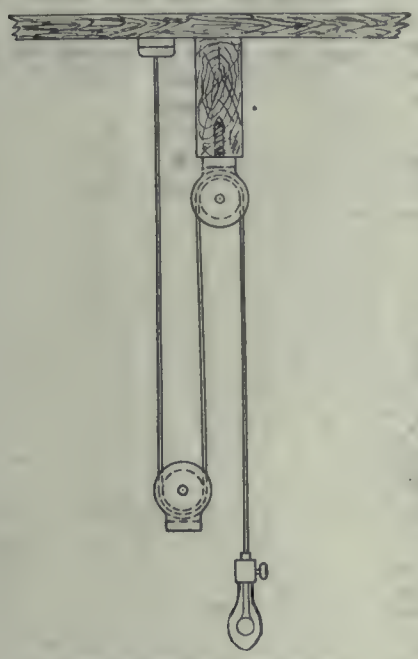
Special Shaper Tool Box.

the construction being clearly shown in the sketch. When about to be used, it is substituted for the ordinary tool box in the shaper or planer, being held in place in the usual way by the hinge pin A. Such a device can be cheaply made up and is more rigid than a cranked tool.

## WOODEN PULLEYS FOR DROP LIGHTS.

By J. H. W.

THE Stevens Company, Ltd., Galt, Ont., use numbers of counterweight drop lights to illuminate their work benches and vises, each lamp being provided with a sufficient length of cord to enable the recesses of cupboards and shelves below the bench to be explored. Wooden pulleys—see sketch—of



Wooden Pulleys for Drop Lights.

about 3 inches diameter are used instead of the small porcelain or metal pulleys usually met with. This not only reduces friction, but also helps to prevent the rubber insulation from cracking and perishing as it so often does when bent over pulleys of small diameter. If the lower pulley is too light to balance the lamp, a few washers or a short piece of pipe are hung from it.

## DEATH OF FRANCIS H. STILLMAN.

Francis H. Stillman, president of the Watson-Stillman Co., and a prominent figure in machine tool and engineering industries, died suddenly, February 18th, at his late residence, Rodney street, Brooklyn, in his sixty-second year. The day before his death, he was at his office as usual and apparently in the best of health. The deceased gentleman was born in New York on February 20, 1850, and graduated from Yale, in the class of 1874, with the degree of B.Sc. He was a member of the Hanover Club of Brooklyn, the Engineers' Club, the American Society of Mechanical Engineers, and a director of the National Association of Manufacturers. He organized and was first president of the Machinery Club of New York, and was also first president of the National Trades Association. In addition to being president of the Watson-Stillman Company at the time of his death, he was also president of the Bridgeport Motor Co., and of the Peouannock Commercial Co., and a director in other manufacturing firms.

## INTERNATIONAL SAFETY CONGRESS.

The new American idea of the safety engineer, an accident prevention specialist, will be brought to the notice of world industrialists at an international safety congress to be held in Milan, Italy, for five days, beginning May 27, 1912. This congress, the first of its kind of international scope ever held, will be for the purpose of setting in motion a world-wide movement for the conservation of human life in industry.

The American Museum of Safety, 29 West Thirty-ninth street, New York, is making preparations so that the United States will be well represented. An American national committee has been selected by the American museum to cooperate with the international body and to promote the American ideas and views at the congress. Dr. W. H. Tolman, director of the American Museum of Safety, and other members of the committee, will attend.

The following are some of the papers which will be read:—

"The Safety Engineer on a Large Transportation System," by Dr. W. H. Tolman, chairman, American national committee; "How the New York Edison Safeguards the Lives and Limbs of Its Employes," by Arthur Williams; "The Work of the Safety Committee of the United States Steel Corporation;" "Safeguarding the Traveling Public and Protecting the Employes of the Electric Street Railway Association;" "Proper Illumination and Accident Prevention," by J. V. Langsingh, president of the Illuminating Engineering Society.—Ex.

## DOMINION STEEL CORPORATION.

THE development of the various industries comprising the Dominion Steel Corporation is to be of the most extensive kind during the present year. The statement was made recently that the company was buying land and would establish a large manufacturing plant on the Island of Montreal. Investigation showed this rumor to be unfounded, but the important fact was revealed during the enquiry that the Steel Corporation will locate a vast entrepot on the canal near St. Ann's Church, and that already a good area of land has been acquired for its future wants. This enterprise means that the company is about to make Montreal a distributing point for their manufactured goods, such as nails, rods and, in fact, all the wire goods which are so soon to be turned out by the large plant that is now being constructed at Sydney for this purpose.

It is also announced that the Steel Corporation will have steamers of their own in the near future not only for the purpose of bringing coal to Montreal, as is the case already, but to carry the products of their improved plant at Sydney up through the canals and to the various points of population and consumption between here and Port Arthur and on to Western Canada. The policy of the corporation will be of the most aggressive character, not only in the way of manufacturing, but in the distribution of their products. The directors, who are extremely satisfied over the present situation, declare that their industry is but in its infancy, and that the extent of the future development of the company's plans cannot possibly be estimated by those who who have not visited the works under way and in contemplation at Sydney.

The financial side of the company's operations have been made interesting by the statement that the company has already been placed in possession of a part of the money coming to it from the sale of $3,500,000 preferred stock to Speyers & Co., the balance to be paid in the near future. As has already been announced, the same financial house will take the other half of the seven million dollar issue when the requirements of the Steel and Coal Companies require the money for the betterment of their plants.

## NEW C. P. R. SHOPS AT CALGARY.

The contract for these shops has been let, the price being in the neighborhood of $2,750,000. Orders for material are now being placed and construction will commence as soon as possible. An endeavor will be made to have the shops in operation by December 1st next. The contract has been awarded to the Westinghouse, Church, Kerr Co., Pittsburg, and calls for the design and construction of locomotive, machine, boiler, blacksmith, pattern, coach, freight, car repair and paint shops; also foundry planing mill, power house, stores and office buildings.

A novel method of overcoming the heating of a locomotive journal bearing was recently described in a trade journal. The brass bearing, which continually ran hot, was raised from the axle and a piece of thin sheet lead inserted between the two. The axle was then lowered on to the bearing and allowed to run as usual. The lead was thus worked into the pores of the brass and the heating ceased. The efficiency of lead in a bearing thus becomes apparent.

# Mechanical Drawing and Sketching for Machinists*

By B. P.

*A Series of Progressive Lessons Designed to Familiarize Engineers With the Use of the Apparatus Necessary to Make Simple Drawings, to Encourage Them to Realize How Important a Factor it is of Their Equipment, as Well as Being a Profitable Pastime.*

THE end of winter and the coming of spring being within measurable distance, it is perhaps only natural that the average man should begin to find evening studies somewhat irksome. In sympathy with this feeling it has been decided to discontinue the present course shortly, and the final instalment will be published in the April issue of Canadian Machinery.

The subject given this month is an ordinary shaft bearing, often called a pedestal or pillow-block, and may be drawn to a scale of either 4 or 6 inches to the foot. The bearing proper is of bronze and is 4 inches diameter by 6 inches long. It is of course split across the horizontal centre line and is prevented from turning by projections top and bottom at the middle of its width. Both half-brasses are cast from the same pattern, a detail of one-half being given in Fig. 2. It will be noticed that these are slightly thicker at the bottom than at the sides and that they fit into the pedestal near the two ends only, the middle part being cast clear and left rough. The pedestal is cast similarly, as the plan view in Fig. 1 clearly shows. In this plan the left-hand half shows a view looking down on the top of the cap or cover, while the right hand half shows a view of the pedestal with the cover removed. The cap and pedestal are of cast iron, and, as seen in the elevation and end view, the former has a boss on the top into which a lubricator may be screwed, the oil passage being drilled through the cap and the projection on top of the brass. These details should be added by the student when making the drawing.

Fitting strips are provided all round the base of the pedestal and across its centre, while to provide for longitudinal adjustment, the bolt holes in the base are elongated. When the brass is worn, adjustment is made by filing across the joint, the cap being tightened down to suit, by means of the two 1¼ inch bolts. In the present example, the holes for these bolts are drilled, while the recesses for their square heads are cored out in the mold. Sometimes, however, the bolt holes, as well as the head recesses are cored, the former being made ¼ inch larger than the diameter of the bolts.

No dotted lines have been shown, but the student should add these, where they may be useful in making the drawing more easily read. Practically all the necessary dimensions have been given either in Fig. 1 or Fig. 2, so that by consulting both figures no difficulty should be experienced in making a complete drawing.

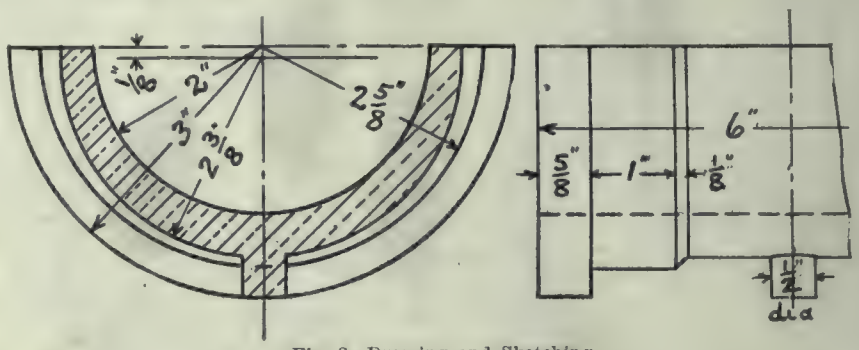



Fig. 2—Drawing and Sketching.

Exercise: — Draw complete separate views of every part of the plummer block shown in Fig. 1, showing clearly the fitting strips below the base.

### Shop Sketches.

It is hoped that readers have followed out the suggestions made in the lesson of November last and have assiduously practised making shop sketches; and further, have afterwards made finished drawings from these sketches, since the latter process serves better than anything to show up the weakness or strength of the sketches.

The principal requirements of a good sketch are accuracy, completeness and clearness. The latter quality is all important, and care must be taken to make all sketches so clear that, even if laid aside for months or years, they may be readily understood when consulted again, without trusting to memory. The beginner too often makes sketches hurriedly and carelessly, carrying certain details "in his head" until the time comes to make the finished drawing. He may then find that his memory has played him false, and he is perhaps inable to gain access a second time to the object he was sketching, which may have gone to the scrap heap or cupola. Hence, the great importance of completeness and clearness in the sketches. Use an H or HB pencil in making them, and a 3H or 4H for the finished drawings.

* Thirteenth of a series of an instruction course.

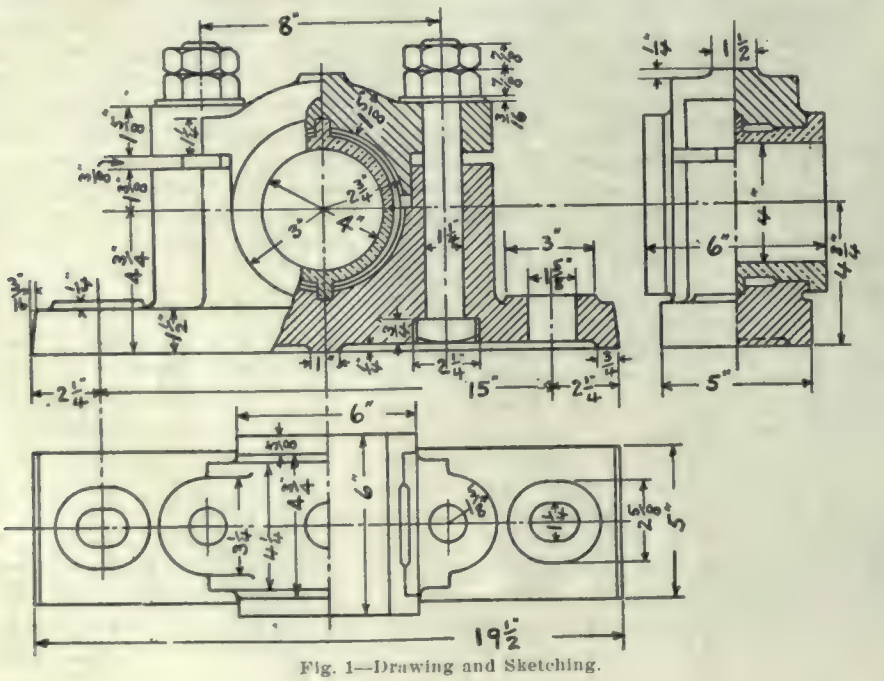



Fig. 1—Drawing and Sketching.

### ELEVATOR CONTRACT.

The contract for the elevators in the new C.P.R. office building, corner of King and Yonge streets, Toronto, has been awarded to the John McDougal, Caledonian Ironworks Co., Montreal.

There will be five hydraulic direct plunger elevators with the necessary pumping and signaling equipment. Three of these elevators for passenger service will have a lift of 188 feet, and one of them a lift of 199 feet. The fifth, used for ashes, etc., will have a lesser lift. The passenger elevators will be provided with every modern device to secure speed and safety in operation, including automatic limit stops, which, independently of the operator, will slow the speed down gradually at the top or bottom without shock or vibration. They will be operated by Worthington compound steam pumps, and will be directed by an elaborate flash light signal system. In general features, these elevators will be similar to those built by the same company for the new C.P.R. Windsor Station, Montreal.

### RAILROAD EQUIPMENT FIGURES FOR 1911.

THE year 1911 was a particularly lean one for equipment companies. The dull business that marked the trade at the end of 1910 continued almost throughout the year. Railroads deferred their buying of cars and other equipment till the latest possible moment on account of the general timidity that was apparent throughout the business world, and all the equipment concerns were therefore obliged to curtail operations and to cut prices in an attempt to induce orders.

Towards the middle of the year most of the companies were operating at much less than half, and in some cases as low as one-quarter of capacity. From January to June the total of car orders placed throughout the country was under 50,000. In the third quarter about 22,000 cars were ordered, and it was only the quickened buying movement starting early in November that enabled the 100,000 mark to be reached.

In November alone more than 40,000 cars were ordered by the railroads and other companies. These, however, were taken at prices that allowed at best little profit to the manufacturer and many contracts are stated to have been taken at actually below cost in order to keep plants running. The price of steel freight cars went down as low as $750 per car, but even with the low prices then ruling for steel plates it was impossible for car builders to make a profit at this figure.

#### Car and Locomotive Orders.

The number of cars and locomotives ordered in the United States and Canada during the year, according to the Railway Age Gazette's annual table, was:—Freight cars, 113,117; passenger cars, 2,623, and locomotives, 2,850. Of the freight and passenger cars slightly under 100,000 were placed with builders in the United States. These figures compare with the orders placed for the 10 years previous as follows:—

| Year | Freight cars | Passenger cars | Locomotives |
|---|---|---|---|
| 1910 ... ... | 141,204 | 3,881 | 3,787 |
| 1909 ... ... | 189,360 | 4,514 | 3,350 |
| 1908 ... ... | 62,669 | 1,319 | 1,182 |
| 1907 ... ... | 151,711 | 1,791 | 3,482 |
| 1906 ... ... | 310,315 | 3,402 | 5,642 |
| 1905 ... ... | 341,315 | 3,289 | 6,265 |
| 1904 ... ... | 136,561 | 2,213 | 2,538 |
| 1903 ... ... | 138,936 | 2,310 | 3,283 |
| 1902 ... ... | 195,248 | 2,459 | 4,665 |
| 1901 ... ... | 193,439 | 2,879 | 4,340 |

**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**

It will be seen from the above table that the number of cars ordered during 1911 was the lowest since 1900, with the exception of 1908, as the figures given above for 1903 are for cars ordered from manufacturers in the United States only.

#### Cars and Locomotives Built.

The number of cars and locomotives built during 1911 was:—Freight cars 72,161; passenger cars 4,246; locomotives 3,530. The following is a table of the number of cars and locomotives built in the United States and Canada in the previous six years:

| Year | Freight cars | Passenger cars | Locomotives |
|---|---|---|---|
| 1910 ... ... | 180,945 | 4,412 | 4,755 |
| 1909 ... ... | 93,570 | 2,849 | 2,887 |
| 1908 ... ... | 76,555 | 1,716 | 2,342 |
| 1907 ... ... | 284,188 | 5,457 | 7,362 |
| 1906 ... ... | 240,593 | 3,167 | 6,952 |
| 1905 ... ... | 165,155 | 2,551 | 5,491 |

The actual number of cars built during the year 1911 falls considerably below the number ordered. This is due to the fact that the largest part of the ordering was done toward the end of the year. These cars were not of course delivered and the new year finds most of the companies with a fair volume of unfilled orders on their books.

#### 1912 Outlook.

The equipment companies are beginning the year with a much better outlook than that of last year. Their operations now range from 45 to 75 per cent. of capacity. Besides the amount of unfilled orders there is every reason to expect more steady buying in the near future. Sentiment everywhere is better and the railroads are showing a greater disposition to fill their needs. Prices also are slowly returning to the normal, as the manufacturers are now in a stronger position than during 1911.—Exchange.

## Personal

Mr. A. S. Herbert, Canadian manager Siemens Bros.' Dynamo Works, has left for England on a business trip.

Mr. T. R. Price has joined the sales staff of the Packard Electric Company with headquarters at Toronto.

Mr. L. W. Morden has been appointed sales engineer of the Packard Electric Company with headquarters at Toronto.

Mr. O. Larsen, late mechanical engineer with the National Bridge Co., and previously connected with Miller Bros. & Toms, and the Montreal Locomotive Works, took over the management of the Pontbriand Co., of Sorel, at the beginning of the year.

W. A. Glasgow has resigned as works manager of the Canadian Steel Foundries, Ltd., at Welland, Ont., to enter other lines of business.

Mr. E. R. Mathewson, general manager of the Anaconda Smelting Works, has been awarded the gold medal of the Institution of Mining and Metallurgy, London, England. Mr. Mathewson is a native of Montreal and a graduate of McGill University.

When drilling very hard metals, it sometimes happens that no amount of lubricating oil or cutting compound will keep the drill cool. In such cases turpentine will be found effective in causing the drill to "bite" and also retain its temper.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## MODERN FOUNDRY PRACTICE*

By Hugh Munro, B.Sc., M.I., Mech. E.**

THE iron foundry is the subject of a great deal of attention on the part of engineers at the present time. Iron founders are charged with the crime of not having made use of the help which science is able to give them, and are said to have made little or no advance relative to the other branches of the iron industry. It is true that mild steel, with predetermined physical properties, can be produced with far more certainty than cast iron of predetermined physical properties. During the conversion of iron into steel, it is under thorough control in melting; its chemical constituents can be adjusted, and its physical properties can be subsequently modified within limits by heat treatment. When melting iron in the cupola, on the other hand, the chemical composition can only be approximately arrived at by mixing two or more brands of iron while charging. During its passage through the cupola, some of the constituents are reduced in quantity, being partly burned out by the blast; others, such as sulphur, are increased by absorption from the coke. The intensity of the blast, the composition of the coke, the nature of the mold into which the iron is subsequently poured, and the temperature at which it is poured, all influence the success of the casting. If heat treatment is applied to ordinary iron castings they usually deteriorate in quality, and finally, if you do get the chemical composition you aimed at, you don't necessarily always get the same physical properties attending it.

The moulder and the chemist must work together to secure success. Scientific control in the foundry, of which so much has been said and written of late, means a great deal more than most people think who advocate it. According to this theory, if a chemist chooses the proper irons for any particular job, all will be well; but this is very far from being the case as I shall show later on. Scientific control in the iron foundry really means more or less investigation into the design of the casting, into the composition of the metal, the temperature of pouring, the composition and tempering of the sand, and the construction, venting, and gateing of the mould. Every new and complicated pattern which comes into the foundry must be considered on its merits. No matter how complicated a casting may be, if there are large numbers to be made, they can, after a while, be turned out with very few wasters by almost any intelligent moulder, but during the early stages of manufacture, and until the peculiarities of that particular pattern come to be known there are often far more wasters than good ones.

A new and intricate pattern often leads to a course of original research on the part of the moulder before he finds out the best way of doing things. If the iron foundry is to be subject to scientific control, it is not sufficient to choose only iron, coke and sand, scientifically. The blast, the temperature of the metal and the construction of the moulds must also be investigated in detail. This is comparatively easy when there is much repeat work, but in an average jobbing foundry where different patterns are in use every day every individual moulder must, or ought to be, a scientist.

### Features of Foundry Practice.

Modern foundry practice covers such a large field that in a short lecture such as this, only a few of the chief features can be dealt with. I propose to review briefly the following points:

(1) Melting Iron.
(2) Shrinkage of Cast Iron.
(3) Defects in Castings—Wasters.
(4) Methods of moulding—Moulding Machines.
(5) Foundry Outfit.
(6) Constituents of Cast Iron.

**Melting.**—For foundry purposes iron is melted either in the air furnace, the cupola, or in some kind of crucible furnace, but the latter is not used to any great extent. Of the other two, although a better quality of iron is obtained from the air furnace, it is not in general use because it melts slowly, and is expensive to operate. The metal is fairly well under control, and its composition may be varied during melting to suit the work in hand. Carbon and silicon may be burned out, or other constituents added exactly as in an open hearth furnace, which in fact it is.

The air furnace is used mostly for large and important castings, such as chilled rolls, where it is essential that the castings should be homogenous throughout. A large quantity of metal of uniform composition can be obtained from this furnace much more easily than from the cupola. Most of the iron for foundry purposes is melted in the cupola. For melting iron cheaply and rapidly, this furnace has no equal, but, unfortunately, after the iron goes into it, there is practically no control over its composition until it is tapped out again into the ladle, and then the time at one's disposal is so limited that little can be done to improve the metal.

The cupola consists essentially of a vertical steel cylinder lined with fire brick. It may vary from 18 inches to 12 feet diameter. The tuyeres through which blast is admitted are usually set about 18 inches above the bottom, and spaced equally round the circumference. In large cupolas, there may be two or three rows of tuyeres one above the other. The iron is charged through a door 6 to 20 feet above the tuyeres. American cupolas have usually a drop bottom, so that when the melt is over, the unburned coke may be dropped out. British cupolas have usually solid bottoms, and the unburned coke is raked out.

When the iron is melted it drops down past the tuyeres and lies in the well of the furnace until it is drawn off, but some cupolas have a receiver into which the metal flows as it is melted. The receiver has a few advantages: (a)—A larger quantity of molten iron can be kept hot there than in the well of the cupolas when it is wanted for a large cast: (b)—The metal is drawn away out of contact with the coke in the cupola from which it absorbs sulphur: (c)—The metal is said to be better mixed in the receiver than if it were collected in the ladle. A receiver is, however, a little troublesome to keep in good condition, and the iron which is first melted may have to be cast into pigs as it is often too cold to be used for castings. The slag is tapped out through a hole higher up than the tap hole.

The cupola is charged by filling with coke up to 18 or 20 inches above the tuyeres, and thereafter iron and coke are charged alternately in thin layers up to the charging door. Melting does not take place throughout the whole charge, but only in a short depth extending from the tuyeres to about 18 inches above them. This is known as the melting zone, and it varies in position with the strength of the blast. When a cupola is blown out, the position of the melting zone can be seen, the

*Lecture before the Glasgow University Engineering Society, December, 1911.

**Superintendent Glenfield & Kennedy, Kilmarnock, Scotland.

firebrick being melted away at this point where the heat is greatest. A small quantity of lime is put in with the iron and coke in order to flux the impurities in the charge. Blast is supplied by Root's blowers, or by centrifugal fans, the former I think being the better of the two. The quantity of coke per ton of iron depends to a great extent on the nature of the work. Iron for light work must be more fluid than that for heavy work in order that it may run freely and fill all parts of the mold. Consequently iron for light work must be hotter than for heavy work, and more coke is therefore required for melting it. Too much coke, however, may have no other effect than that of making the furnace melt more slowly without producing hotter iron. For instance, if the first coke charge were just up to the top of the melting zone with the iron just above it, melting would begin a few minutes after the blast was turned on; but if the top of the first coke charge was 12 inches above the melting zone this amount of coke would have to be burned away before melting began, and it would be wasted. When the blast leaves the melting zone it consists of nitrogen and C.O. In many cupolas, this C.O. passes up through the coke and burns when it meets the atmosphere at the charging door or at the top of the cupola. If a second row of small tuyeres be placed a few feet above the melting zone, this gas can be burned in the furnace so as to heat the charge and effect great economy in coke. It is, of course, important that the oxygen supplied by these auxiliary tuyeres should not combine with the coke. The blast from these tuyeres should, therefore, be not intense and local, but rather, low in pressure and diffused over as large an area as possible.

The blast for a cupola may vary from 8 to 20 inches of water, and good results can be obtained from both extreme pressures, depending on the nature of the coke and rate of melting. The amount of iron melted per ton of coke varies from 8 to 12 tons, and here, again, either extreme may be good practice, depending on what the iron is required for. Limestone may be used up to 60 lbs. per ton of iron. The coke should be hard and free from sulphur to give good results. An average composition of good coke is as follows:—

Ash, 6-10 p.c. S., .5 to 1 p.c. H.O., 1 p.c. Carbon, 80-92 p.c. Volatile, 1 p.c.

Moisture in coke does not seem to affect the iron in any way, as it is all evaporated before the coke reaches the melting zone. Limestone should be free from Al. and Si. Iron in passing through the cupola undergoes certain variations in its chemical and physical structure. A small proportion of silicon and manganese is burned out by the blast, sulphur is absorbed from the coke, and some G.C. changes to C.C. Phosphorus usually undergoes no change. The iron becomes harder and denser, and closer in grain after re-melting. It shrinks more, and an open iron usually becomes closer and stronger. A small percentage of iron passes into the slag and is lost, but it is difficult to say how much this amounts to. When an iron of a definite composition is required, the correct quantity of each brand is taken for the charge and allowance is made for the changes which take place in the cupola.

It is becoming a common practice to melt mild steel in the cupola along with iron. The resulting metal (known in America as semi-steel) is lower in Si., G.C., and total carbon than if all cast iron were used in the charge. Any quantity of steel up to 25 per cent. may be used. The proper method of using it, however, is not quite understood, and it is rather risky to use it in large proportions on machined work, as it tends to produce blow holes. Generally speaking, it strengthens and toughens the iron, makes it closer in grain and harder. The results sought by the use of steel can usually be got by choosing proper brands of iron. The proper mixture of iron to use for different classes of castings is a most important part of the iron founder's art. In all foundries some attempt is made to put into a mold the iron most suited for the casting. Two or three brands of pig iron are used and mixed with scrap in the proper proportions while they are being charged. A common charge for every day work is half scrap and half No. 3 pig. For soft castings, easily machined, some of No. 1 pig is put in along with the scrap, while the proportion of No. 3 is reduced. Blast of low pressure tends to produce softer castings than a high pressure blast. In an ordinary jobbing foundry where all classes of work are being made, several different qualities of iron may be required in the course of a melt of three or four hours' duration.

### Shrinkage.

During cooling cast iron contracts both in the fluid and in the solid state. The former is termed fluid contraction, and the latter is technically known as shrinkage. The amount of shrinkage of cast iron is pretty well known. It amounts to about $\frac{1}{8}$ inch per foot, and is allowed for by making the pattern that amount larger than the casting. Shrinkage varies considerably, according to circumstances. It is greater in thin castings than in thick ones; in quickly cooled castings than in castings slowly cooled, and in green sand castings than in those made in dry sand or loam. Increase of Mn., C.C., and S. increase shrinkage, while increase of G.C., Si., and P. diminish shrinkage; and white iron shrinks more than grey iron.

If castings are unequally proportioned, severe internal stresses are set up in them owing to unequal shrinkage. For instance, in a wheel with a heavy boss and a light rim the boss contracts last, and in doing so puts a severe tensile stress on the arms, often causing them to break. Wheel arms, for this reason, are often curved, or the boss is split to eliminate cooling stresses due to unequal contraction, and afterwards hooped. Long castings such as lathe beds, in which one side of the casting is thick and the other side thin, bend in cooling, and the pattern should be made with an initial set so that the casting may come out straight. As the most extreme example I have ever come across, I may mention a casting, 36 feet long, weighing 14 tons, and having one side 3 inches and the other $1\frac{1}{4}$ inches thick, which bent 3 inches in cooling. The pattern had been made with a camber of $2\frac{3}{4}$ inches in the opposite direction, so that the casting when finished was only $\frac{1}{4}$ inch bent. It was concave on the thick side. In large thin castings it is necessary to loosen the cores soon after pouring in order to allow the casting to shrink freely; if this is not done the core may prevent the iron from shrinking and cause it to crack.

According to a series of experiments made by Keep, under the auspices of the Am. Soc. M.E., cast iron does not shrink uniformly from the time it becomes solid. Just after solidification it expands; then contracts, expands again, and contracts, and sometimes it may expand a third time before the final and regular shrinkage begins. During this period of expansion and contraction, a great change takes place in the internal structure of the metal. Solid cast iron, as you know, may contain up to 3 per cent. free carbon in the graphitic form. This is assumed to be in solution while the iron is fluid, and is generally supposed to assume the graphitic form during the act of solidification. From the above named experiments, it has been found that when cast iron first solidifies, the carbon is still combined with the iron, and not until the final shrinkage begins has all the graphitic carbon separated out. These expansions and contractions, and the change from C.C. to G.C. extend over a varying period of time, depending, of course, on the rate of cooling of the casting.

If the iron is cooled quickly, the C.C. has not got time to separate out, the casting is hard and does not contain much if any, graphitic carbon, while the alternate expansion and contraction just after solidification are much less pro-

nounced than when the casting is cooled slowly.

Since cast iron first expands on cooling from the fluid state, it follows that if molten iron is cast around an iron core, this core may be withdrawn easily while the iron is hot, and before the ultimate contraction has commenced. Keep's experiments also indicate, that, if molten iron is cast in chills and taken out of the chill as soon as it has solidified, the casting is not chilled very hard.

### Fluid Shrinkage.

Although solid shrinkage is so complex in its operations, it is easy to make allowance for it. Fluid contraction is much more difficult to deal with. The defects in castings known as draw holes, shrink holes, sponginess, are due almost wholly to fluid contraction.

The moulder has his own methods—not always successful, for counteracting the effects of this vice in cast iron, but a great deal may also be done in the drawing office to lessen opportunities for it to exert its influence. Unfortunately for the founder, it is too frequently impossible for the drawing office to design castings in which fluid contraction can be wholly avoided. If a casting is of such a shape that part of it remains fluid after the parts surrounding it have become solid, the fluid part contracts while solidifying, and, having no reservoir of fluid iron to draw from, a hollow space forms in the casting and is termed a draw hole or shrink hole. More frequently, instead of a hole, the metal becomes soft and open in texture, and allows water to pass through it easily, and the iron is then said to be spongy. The drawing office can do its share towards lessening sponginess by designing castings of as uniform a thickness as possible. The metallurgist does his part in finding an iron with small fluid contraction. The moulder meets the difficulty in various ways, the most common of which is "feeding." Feeding consists in putting risers or feeders on the thick parts of the casting, filling these feeders with hot metal, and keeping a passage open between the iron in them and the interior of the casting until the latter has solidified. Rods are worked up and down in these feeders to prevent them solidifying, and in large castings hot iron is poured in to make up the loss caused by contraction. If the casting is a plain cylinder, a feeding head or sinking head may be cast on the top of it. This head is thicker than the casting; it remains fluid longer, and feeds the casting automatically. The head is afterwards cut off. If feeding by hand be carried to excess a draw hole may appear on the surface instead of in the interior of the casting. It is not always possible to feed the thick part of a casting, therefore, it is common practice to chill it, that is, the mould at the thick part is lined with cast iron blocks which cause this part of the casting to solidify first, or cast iron chills of a special shape may be stuck into the mould and project right into the thick part of the casting. These chills unite with the molten metal and become part of the casting while the part which supported it in the mould is afterwards broken off. The open texture of cast iron which is frequently seen in thick castings is not always due to fluid contraction, but may be caused by too much silicon, or slow cooling.

Very little is known about fluid contraction. Some irons no doubt possess it to a lesser degree than others, but we don't know how it is affected by the chemical composition of the iron. When thick castings have got to be drilled, it is often a difficult matter to prevent them leaking afterwards under high pressure. I have found that if a cast iron core is cast in and afterwards drilled out, this trouble of leaking disappears. A sand core could be used, but would be likely to get washed away when the mould is being filled.

## NEW HOT GALVANIZING PROCESS.

A new hot galvanizing process patented by Prof. Chas. F. Burgess, of the University of Wisconsin, Madison, Wis., differs from other processes heretofore in use, in that an alloy of zinc and iron forms the coating instead of pure zinc. The patents have been assigned to the United States Sherardizing Co., New Castle, Pa.

The process consists in using an alloy of zinc and iron for coating the iron or steel goods to be galvanized. The alloy is made by allowing thin sheet iron to dissolve in molten zinc until an alloy of about 92 per cent. zinc and 8 per cent. iron is obtained. This alloy is quite brittle and is powdered or granulated. The articles to be galvanized are placed in an iron tumbling barrel with this zinc-iron alloy in the granular form and heated while the tumbling is going on. The heat is maintained at about 850 degs. F. The heating is continued for two hours or more. It has been found expedient in the process to supply zinc so that the iron content of the alloy will not increase. Zinc dross (containing about 3 per cent. of iron) is, therefore, introduced into the barrel in the form of large lumps and the tumbling allowed to proceed. These lumps become readily broken up in the hot barrel and mix with the granulated zinc and iron alloy.

The coating of zinc and iron alloy obtained on iron and steel goods by this process is, the inventor says, very dense and silver-white in color. It is electropositive with respect to iron, but not to the extent that pure zinc is. The inventor says that this is quite an advantage, as the coating, when exposed to the atmosphere, is not corroded as rapidly as zinc, and yet it protects the iron or steel underneath equally as well.

If desired, the zinc and iron alloy may be made by using zinc dross entirely and placing it in the barrel along with the goods to be galvanized. The heat and tumbling break up the lumps. To supply the iron, small pieces of scrap iron are introduced with the zinc dross.—Ex.

## MELTING BRONZE IN A CUPOLA

Mr. P. D. Malloy, writing in the "Obermayer Bulletin," says: "I have taken out a heat of bronze metal from a No. 5 Whiting cupola by charging the latter in the same manner as for a heat of grey iron. I put on the blast at 2.30 p.m., and in 25 minutes, tapped the cupola and took off 1,350 pounds. Swinging the crane ladle around to the mold before pouring, holding ladle twenty minutes, then swinging crane ladle back to the cupola, I tapped out again from 300 to 400 pounds. It took just one hour to take off the heat, containing from 1,600 to 1,700 pounds of metal. In this heat the shrinkage was very low. By regulating the tuyeres, there is no trouble in running out the metal at any heat necessary. I carried the blast at from 7 to 7¼ ounces, and connot see why bronze metal cannot be run out of a cupola successfully."

## MONEL METAL PROPELLER FOUNDRY PRACTICE.

By C. T. R.

THE increased use of Monel metal for propellers has been very noticeable and its inherit properties make it remarkably adaptable for this work. Engineers early recognized that this "natural" alloy which consists of approximately 67 per cent. nickel, 27 per cent. copper, and 6 per cent. of other metals, principally iron and manganese, would find a large demand for propeller use provided it could be cast successfully. On account of the relatively scant knowledge of nickel and its peculiarities, considerable difficulty was experienced by foundries that first attempted to cast Monel metal propellers, but all obstacles seem to have been overcome by

the Bayonne Casting Co., Bayonne, N. J., who have successfully cast Monel metal propellers of 18,000 pounds each, and, in fact, have made castings of 25,000 pounds weight in one piece. It will, therefore, be interesting to note the foundry practice of the Bayonne Casting Co., according to information furnished by the Ruggles-Coles Engineering Co., of New York, who act as general sales agents for this company.

**Practice of Casting Monel Metal.**

The practice of casting Monel metal is very similar to that followed in many steel foundries. As the melting point is high, being about 2,500 degs. Fah., eight hours are required for heating. The melting plant consists of standard reverberatory furnaces which are oil fired, the fuel being fed by gravity and the melting being done by natural draft. The furnaces are charged with the metal in the form of pigs or slabs that weigh about 35 pounds each. No fluxes or alloys are necessary. At present the melting capacity of the plant is about 40,000 pounds daily, consisting of one furnace with a capacity of 30,000 pounds, another of 7,500 pounds, and a third of 2,500 pounds. Included in the shop equipment are also several Rockwell furnaces of 200 pounds capacity each.

In casting the large propellers, pits are used of 25 feet diameter and 5 feet deep. These are built in the form of submerged steel tanks with rolled plates. The adoption of this construction was due to the shifting nature of the ground on which the shop is located, and its proximity to tide water; further, the cost of construction was less than concrete. On the bottom of the base plate, an ordinary loam mold for the casting is built up. Millville gravel from New Jersey deposits is used, being the same grade of sand used by the steel foundries in the vicinity. The heat of the molten metal when poured exceeds that of steel and therefore an exceptionally good facing is requireo. The ramming of the mold is done by air rammers of the floor type and after the mold is in position and dried, the copes are bolted on to the base plate and a runner box with four apertures which feed directly into the mold is placed upon the copes and the head box inserted. The feeding is performed quickly from a 30,000-pound ladle into which the furnaces are tapped. This rapid pouring is necessary for the elimination of dross that otherwise might collect. The molten metal pours quite similarly to brass. The casting is allowed to set for four days in the mold before it is taken out. A 20-ton electric traveling crane with a 5-ton auxiliary commands the operations. There are also two 7½-ton jib cranes which serve for handling the metal in about one-third of the entire shop.

**Monel Metal Propellers in Service.**

Heretofore, propellers have been made largely of various kinds of bronze, particularly manganese bronze, but with the rapid development of the marine turbine the demand for a propeller metal that would stand even better the severe shock of high speed service, became manifest. Monel metal propellers have supplied this need and some of the largest fighting ships are equipped with them. The Argentine Republic's battleship "Rivadavia," claimed to be the largest and most powerful naval ship in the world, has three Monel metal propellers each of 16,000 pounds, and three similar ones have been cast for the same Republic's battleship "Moreno" now in construction at Camden. The U.S. battleship "Florida," is equipped with four 8,000 pounds each Monel metal propellers, while the "North Dakota" is fitted with two of 18,000 pounds each. Many torpedo boat destroyers of the U.S. navy are fitted with Monel metal propellers, most of them being of the three-bladed design, weighing about 2,000 pounds each.

It is interesting to note that a recent inspection of the U.S. battleship "North Dakota" in dry dock showed that the Monel metal propellers used suffered little effect of their long service. The bright silver polish of Monel metal propellers was well retained, and the enormous strength of the material prevents changes of pitch and the consequent losses of efficiency.

MONEL METAL PROPELLER FOUNDRY PRACTICE.

## AUTOMATIC CAN MAKING MACHINERY.

WHEN it is considered that by far the vast majority of the food products which we consume come in tin cans, it is not difficult to realize that machinery for making these cans is a very important branch of manufacture.

Tin cans used for food products may be roughly divided into two main classes:—First, there is the soldered or packers' can, Fig. 11; and then there is the open top or so called "sanitary" can, Fig. 10. In the case of the packers' can, one of the ends has an opening which is somewhat smaller than the diameter of the can, and it is this opening which is closed by a soldered cap, after the goods are put inside. In this form of can, not only is the side seam soldered, but also the top and bottom are soldered to the body.

In the case of the open-top, or sanitary can, these are shipped with only the bottom in place and with the entire top separate. For these cans there is no small cap to be attached to the top, but the head of the can itself forms the cover. In the sanitary can, the top and bottom seams are folded over upon themselves or "double-seamed," and there is no solder used in the top and bottom seams. In order to make these unsoldered seams air-tight, a thin coating of a rubber-like substance is applied to the parts before they are put together and the tight rolling down of the double seam squeezes this material in the space between the sheets, entirely filling up the cracks and making them air-tight. While it is supposed that this form of seam makes a sanitary can, due to the absence of solder and the necessary application of acid in the soldering process; this is an exaggeration, for even in the sanitary can, the side or body seam is soldered, just as is the case with the ordinary packers' can.

Fig. 2.—Press with Stagger Gauges and Tables.

### Forming, Seaming and Soldering the Bodies.

Slitting the sheets of tin into strips which are afterward formed into can bodies is the first step in the manufacture. This slitting is done on a machine, carrying several rotary slitting cutters on an arbor. After the sheets have been cut to width and length, they are taken to the machine shown in Fig. 1. Here they are piled in the receiver A, and a suction arm is brought up, drawing away the bottom sheet by means of vacuum, produced by the vacuum pump B, also shown in Fig. 1. This sheet is next carried to the notcher at C. Here, when making bodies for the open-top or sanitary can, notches are cut from the corners of the sheet, the object of this notching being to remove the metal where it would be doubled over in too many thicknesses when the ends are double-seamed. For a packers' can whose end seams are not folded over, this notching is unnecessary, and this portion of the machine is omitted.

After this, the sheet passes on under the yoke shown at D, where a pair of arms rise up to curve the sheet around an arbor or horn. While being carried to the arbor the sheet is edged, that is, the two edges are hooked; one edge turned up and the other turned down, at a little more than a right angle; then, when the sheet has been wrapped around the arbor, the two hooks lock together. At this point wedges enter the arbor, causing it to expand and draw the metal tight, while the yoke at E comes down and presses the lock seam tightly together. This makes the seam in the side of the can body, which, however, is not air-tight, but has to be soldered.

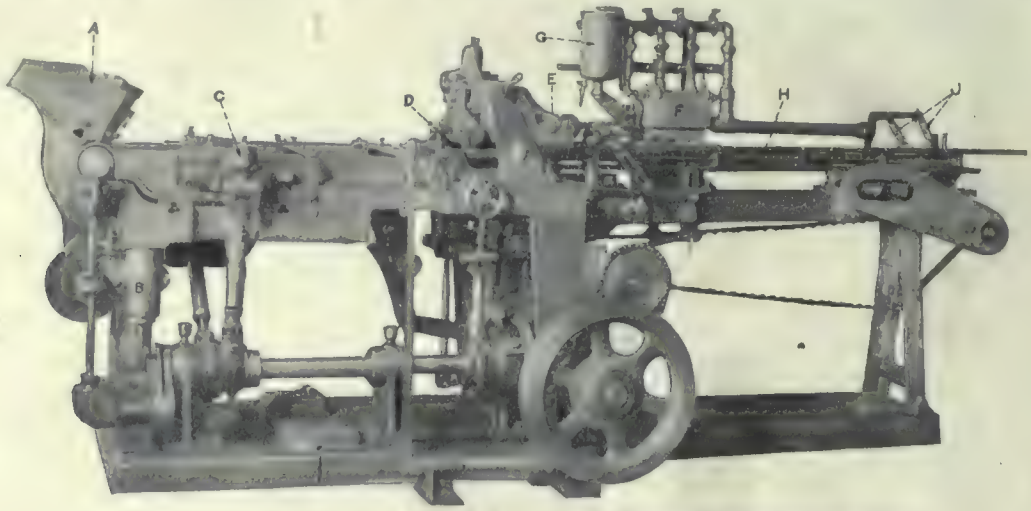



Fig. 1.—Automatic Lock-seam Body Making and Side-seam Soldering Machine.

Soldering is done after the arbor has released the can body, and it is carried along the conveyor H, passing first under an acid applier and then under the soldering iron below F. This consists of a piece of iron loosely supported inside of a frame having numerous Bun-

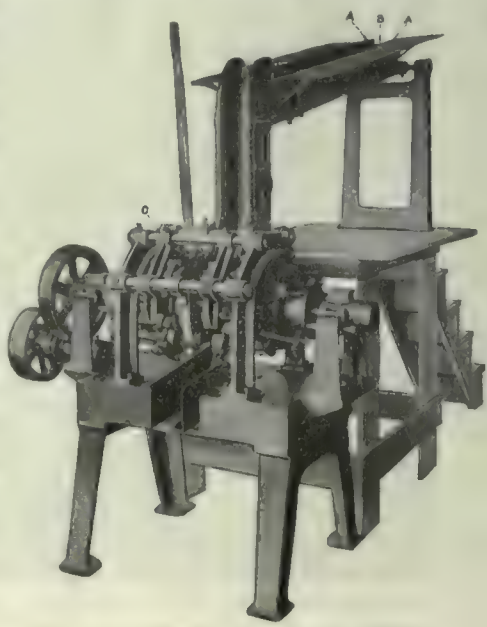


Fig. 3.—Automatic Round-can Header.

sen gas flames playing upon it. The iron thus being hot, a continuous piece of wire solder is fed against it and as the can bodies pass below it, this solder is transferred to the seam of the can, penetrating into the cracks between the sheets of tin, so as to make the seam

Fig. 4.—Automatic Floater or Head Soldering Machine.

tight and impervious to air. This done, the can body is carried further along the conveyor H and passes under the two solder wipers J, which wipe off any extra solder which may adhere to the top of the seam.

**Stagger Feed Press.**

In Fig. 2 is illustrated a press which stamps out can heads and at the same time presses them into the cupped shape which they must have in order to fit over the end of the can body. In this particular press, what is known as the "stagger feed" is applied, so that the round holes punched in the metal, being staggered, fit together much more neatly, making considerably less scrap than would be the case if the holes were not staggered. Also, a pair of shears, removes the flimsy scrap metal, to get it out of the way.

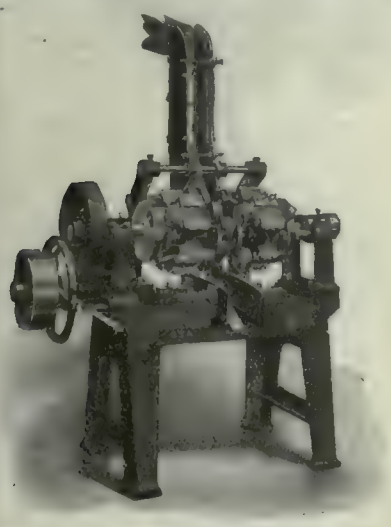


Fig. 5.—Automatic Round Can Flanger.

**Heading Without Crimping.**

When the can bodies and heads have been made, it is necessary to put these together. By the older methods, it was customary to make the head with a slightly flaring lip, so that it would fit easily over the end of the can and then it was necessary to mash or crimp this flaring edge down against the can body, to make it reasonably tight before soldering. With modern methods, however, the accuracy of the parts is such that it is possible to put the can heads directly onto the body, without any flaring and after-crimping. This is secured by feeding the heads into recessed dies, the shoulder of which guides the can body directly into the head.

In Fig. 3, one of the heading machines is illustrated and the bodies are fed into the trough at B, coming down through the centre of the machine, while the tops and bottoms are fed in through the narrow slots at A A. In the revolving part C, the head and bottom of the can are forced on over the body, there being numerous molds following around, one after the other, and pressing the heads and bottoms into place, so that a speed of 140 cans per minute is possible. These machines are also adjustable for various sizes, this one in particular being suitable for diameters of from 1½ in. to 4½ in. and lengths from 1¾ in. to 7 in.

**Automatic Soldering.**

As previously intimated, the next step after forcing the tops and bottoms upon the ordinary packers' can is to solder these tops and bottoms in place. This is done by the machine shown in Fig. 4, which is known as a floater. Observing this illustration, the trough C holds melted solder, kept hot by numerous gas flames beneath. The bottle D supplies a tray with acid which,

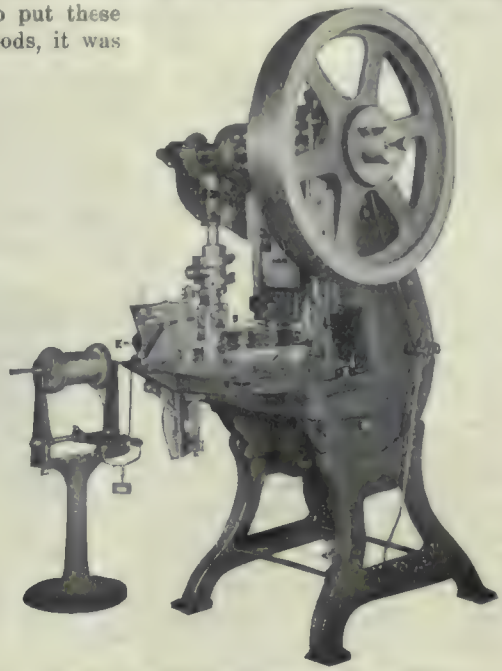


Fig. 7.—Solder Cap Hemming Machine.

of course, must first be applied to the parts. Cans coming from the header are fed into the conveyer at A, where they drop down to the tray and are rolled along on edge, slightly tipped up, so that one seam will dip and roll in the acid and then on to the tray C, where the can edge rolls along in a similar manner, in melted solder. The solder creeps up into the seam, following the acid and making an air-tight joint.

At the end of the solder tray the cans are dumped off, raised up in the conveyer shown above the machine, and brought back to the chute at B. From here they drop down and pass along the left-hand side of the conveyor, put-

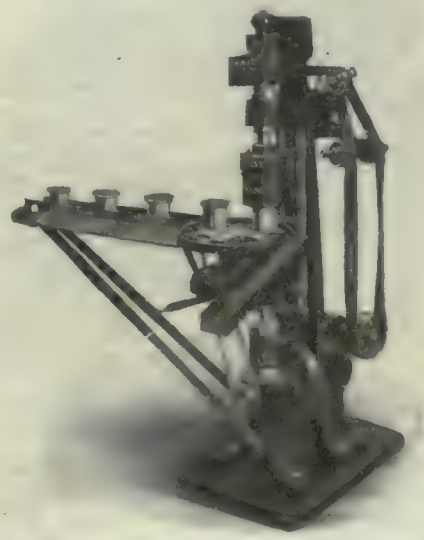


Fig. 6.—Automatic Stand-still Double Seamer.

ting the other end seam of the can, first in the acid and then in the solder, so as to seal this end as well. At the extreme end of the machine the cans are brought out upon the cooling belt, where the solder has time to harden. Provision may also be made for wiping off the excess solder. Such machines are built for a speed of 150 cans per minute and are adjustable to a wide range of sizes.

**Double Seaming Sanitary Cans.**

So far, we have been talking about packers' or solder-end-seam cans. To go back to the sanitary can, it will be remembered that the end seams in these are folded over on themselves or double seamed, there being no solder. The first step in obtaining this double seam is to put a flange all around the can by expanding the ends of the can body, that is, flaring the ends out at about a right angle. This operation is performed on the machine shown in Fig. 5, which is continuous in operation, takes a wide range of sizes, and flanges at the rate of about 140 or more bodies per minute. The bodies are fed down through the chute shown.

Before attaching to the bodies, the bottoms, which are stamped out by the press already shown, are passed through the compound applying machine shown in Fig. 9, this machine being used to apply the sealing compound. The tops or bottoms being fed into a dial are automatically carried into the machine, where by means of rolls the sealing compound is applied, after which they are discharged into a conveyer dryer (not shown). After passing through the dryer they are ready for the double seaming operation.

The can body, with bottom in place, is now placed on the conveyor of the

Fig. 8.—Automatic Can Tester.

machine shown in Fig. 6, known as the double seamer, and carried to the revolving dial, which automatically feeds it under the double seaming head. Four double seaming rolls are used. Each operation is accomplished by two rolls acting simultaneously at opposite points of the bottom, thus balancing the pressure and lessening the twisting tendency. During the double seaming the can stands still. After double seaming it is automatically carried away and deposited in a chute. This machine is also used for double seaming the tops on the filled cans.

**Hemming the Solder Cans.**

Fig. 7 represents what is probably the most interesting of all these can-making machines. This is known as the solder-cap hemming machine, and is

Fig. 10.—Sanitary Can.

Fig. 11.—Packers' Can.

used for applying solder to the edges of the small caps which are used to close up the final small opening in the top of a packer's can. In the illustration a large number of caps are shown on the table of the machine and they are fed to dies in a revolving dial plate, one die being visible at D and one on each side of it. Wire solder is fed from the reel and passes under the press A, where it is cut off and formed into a ring. It is then passed on by the revolution of the dial plate to the punches B and C, where it is flattened out, that is, the round wire is made into a flat rim, somewhat like a narrow gasket, and formed to fit the cap.

At D the operator places a cap, which is saucer shaped, on top of the solder ring and the two are then carried under the subpress E, where one edge of the thin, round sheet of solder is folded entirely over the edge of the cap and pressed down tight around the rim. No heat is applied, but the shape of the ring and the pressure hold it very rigidly in place on the edge of the cap. Beyond the subpress E, the dies automatically eject the caps with the solder in plate. These caps are shipped to the packer who, after the cans have been filled, solders the caps to the tops of the cans by other special soldering machines.

**Automatic Tester.**

One of the most important machines is shown in Fig. 8. This is the can tester and, as it name implies, its function is to discover the imperfect or leaky cans. The very minutest opening to air is sufficient to start fermentation in canned goods and the can manufacturer is forced to guarantee to the packer that not more than two cans per thousand shall show an air leak. With this limit of error it may readily be understood that careful inspection is necessary, even with the best of machinery.

Packers' cans are fed to this testing machine from a chute coming from the floater or soldering machine, and in the case of the sanitary cans, from the double-seamer. As the cans are received they are automatically gripped between the round plates carrying rubber gaskets, and as they are carried around and dipped into the water tank beneath, air at a pressure of from 15 to 20 pounds per square inch is applied through the center of the plates holding the cans in place. An operator at one side then carefully observes if any bubbles arise from the water, denoting a leak, and if one is discovered, the operator removes the leaky can. The other cans, which are perfect, are not disturbed by the operator but are carried up further and automatically dropped down to a chute to carry them off.

Driving of this machine is quite slow so as to prevent stirring up the water and forming bubbles from other causes than leaks. This slow speed necessitates the large number of can carriers, the particular machine illustrated having 30 and a capacity of 120 cans per minute. The air pressure is applied only to those cans which are under water. Another effort to eliminate disturbance in the water is to drive the machine by worm gearing, instead of spur, thus reducing vibration. It is said that with machines of this character, retests of all the cans passed through the machine in a day have repeatedly shown not a single leaking can among those passing out through the perfect chute during this time.

Fig. 9.—Compound Applying Machine.

Through the courtesy of the E. W. Bliss Company, of Brooklyn, N.Y., who are the manufacturers of these machines, we are enabled to reproduce the accompanying illustrations.

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# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Bancroft, Ont.**—Payne's machine shop and electric light plant were destroyed by fire recently.

**New Westminster, B.C.**—The New Westminster Foundry Company are erecting a $1,000 iron foundry here on Braid Street.

**Hampton, N.B.**—J. M. Logan's machine shop was destroyed by fire recently. The loss is only partly covered by insurance.

**Owen Sound, Ont.**—Fire damaged the plant of the Owen Sound Wire Fence Co. here to the extent of $20,000, covered by insurance.

**Vancouver, B.C.**—Col. Davidson, who was here recently, announced that Port Mann will be the site of an iron works, car shops, a working establishment and a dry dock.

**Medicine Hat, Alta.**—The civic industrial committee is in touch with a company which proposes to establish a steel works here.

**Medicine Hat, Alta.**—The Alberta Foundry & Machine Co. are enlarging their plant here, and expect to have the additions completed by the middle of March.

**Meaford, Ont.**—Toronto interests have secured the Corley farm and it is rumored that a new manufacturing company will establish a tile and sewer pipe plant here.

**Vancouver, B.C.**—Sir Donald Mana was here recently, and definitely announced that the C. N. R. would locate the principal repair shops of the company at Port Mann. He also confirmed the report that Port Mann is to become the location of exteasive private industries, including a freight car building works.

**Galt, Ont.**—The big Goldie & McCulloch boiler shop, the largest in Ontario, has become too small and will be greatly added to. The new addition will be one-third the size of the present shop.

**Brandon, Man.**—Messrs. Thomas and Cloutier, of this city, have secured the rights for Manitoba to manufacture the Only Elliot Belt Guide. A factory will be erected in the near future and machinery installed.

**Port Colborne, Ont.**—The Canadian Safety Appliance Co. have been registered and will establish a factory here. Electrical appliances of all kinds will be manufactured here.

**Welland, Ont.**—The Canadian Steel Foundries propose erecting a big blast furnace here to cost $1,500,000. Ground will be broken in the spring.

**St. Thomas, Ont.**—The Gasolectric Motors, Ltd., have decided to locate their head office here, and it is highly probable that the Canadian plant will also be established here. E. H. Thomas, of this city, is the president.

**Montreal, Que.**—A. C. Stead and James Hutchison, joint liquidators, of this city, are advertising the assets of the Parker Foundry Co., in liquidation. The plant consists of steel and grey iron equipment and appliances.

**Cardston, Alta.**—The Folsom Iron Works have made various improvements in their shops here recently. A new 10 h.p. gasoline engine was also installed.

**Winnipeg, Man.**—At a meeting of the shareholders of the Manitoba Bridge & Iron Works recently it was announced that an entirely new plant will be erected. Plans will be drawn for a plant said to be the largest in Canada, with the necessary accessories of foundries for steel and grey iron castings, machine shops, forge shops, etc. A new site will be acquired within a reasonable distance of Winnipeg.

**North Bay, Ont.**—It has been reported that the C. P. R. propose expending a large sum of money to erect repair shops and extensions here. The reported plans call for a six-track car repair shops 175x140 feet.

**Norwood, Man.**—The Winnipeg Steel Culvert & Granary Co. have taken out a permit for a new building, to cost $7,000, to replace the one destroyed by fire recently.

**Kingston, Ont.**—Plans involving an expenditure of $1,000,000 for the enlargement of the locomotive works here have been completed. Additional storeys are to be built to the present buildings and several new structures are to be started near William Street.

**North Bay, Ont.**—The town is asking the C. N. R. to guarantee shops or a divisional point, in return for certain valuable concessions here.

**Kingston, Ont.**—The Buffalo-Ontario Smelting Co. have secured a site and will establish a smelter here in the spring. The company's operations will be limited at first, but it is said that the ultimate expenditure will approximate $300,000.

**Toronto, Ont.**—Fire at the Queen City Foundry Co., at the foot of West Market Street, did damage to the extent of $2,200.


# Electric Traveling Cranes for all Kinds of Service

Interior View of Foundry of the Indiana Steel Co., Gary, showing one Morgan 40-ton 4-Motor Crane and one 25-ton 4-Motor Crane, also two 5-ton Wall Cranes.

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**Merritton, Ont.**—A branch factory of the Presto Light Co., of Indianapolis, Ind., will be established here this spring. They will carry on the manufacture of automobile, carriage, boat, bicycle and other varieties of lamps. The initial expenditure will be $4,000.

**Montreal, Que.**—At a meeting of the Maisonneuve council recently a request was read from the Belgo-Canadian Co., asking exemption from taxation and other advantages in the event of their establishing a steel works in Maisonneuve. It was stated that the construction of their workshops involved an expenditure of $125,000.

**St. John, N.B.**—The Petrie Manufacturing Co., Hamilton, Ont., makers of the Magnet cream separators, have purchased a site here and will erect a warehouse and office to accommodate their Maritime trade.

**Hamilton, Ont.**—Schweler & Stephenson, machinists and engineers, have purchased Richard Quinn's machine shop, at 134 North Bay Street.

**Victoria, B.C.**—The Victoria Machinery Depot has made an arrangement with the Astoria Iron Works, of Astoria, Oregon, whereby all the can-filling machines patented by this firm ordered in British Columbia will be constructed at the Victoria Machinery Depot.

**Sarnia, Ont.**—Plans for the brass factory to be erected here by the Mueller Manufacturing Co., of Decatur, Ill., are well under way and construction will begin in the near future.

**Hamilton, Ont.**—It is rumored that the Union Drawn Steel Co. contemplate enlarging their plant here in the near future.

**Calgary, Alta.**—The Sawyer-Massey Co., of Winnipeg and Hamilton, propose erecting a warehouse here for the purpose of storing goods and making repairs.

**New Westminster, B.C.**—The Canadian Talbot Boiler Co. will establish a plant here to manufacture an improved marine and stationary boiler. The product is said to be indestructible—Cannot scale, pit or prime—occupies one-half the space of other standard tubular boilers, and weighs one-third. One of these boilers on exhibition here is a 25 h.p. and weighs 1,625 lbs. It has been tested to 2,000 lbs. pressure.

**Winnipeg, Man.**—The Excelsior Motor Works here suffered $75,000 loss by fire some time ago.

**Sherbrooke, Que.**—Three iron industries have been seeking loans from the municipality for the purpose of establishing and extending their plants here—the Jenckes Machine

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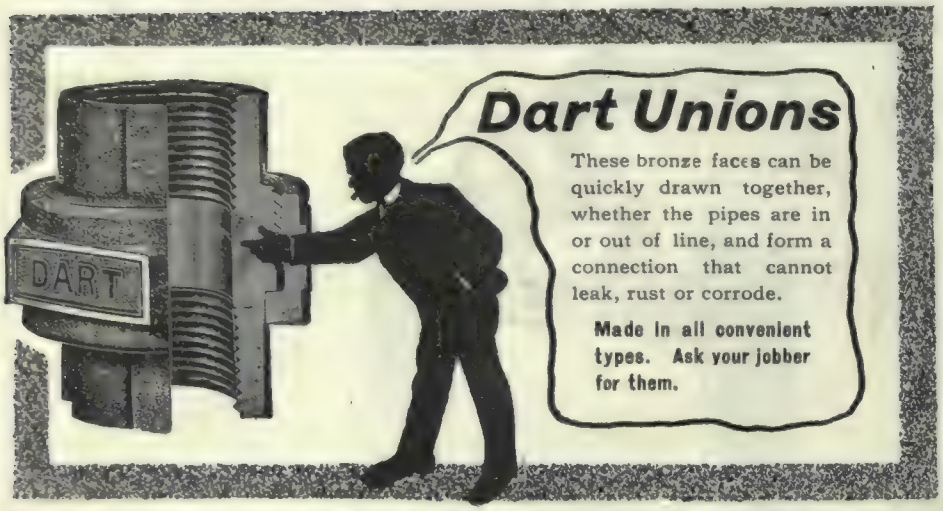
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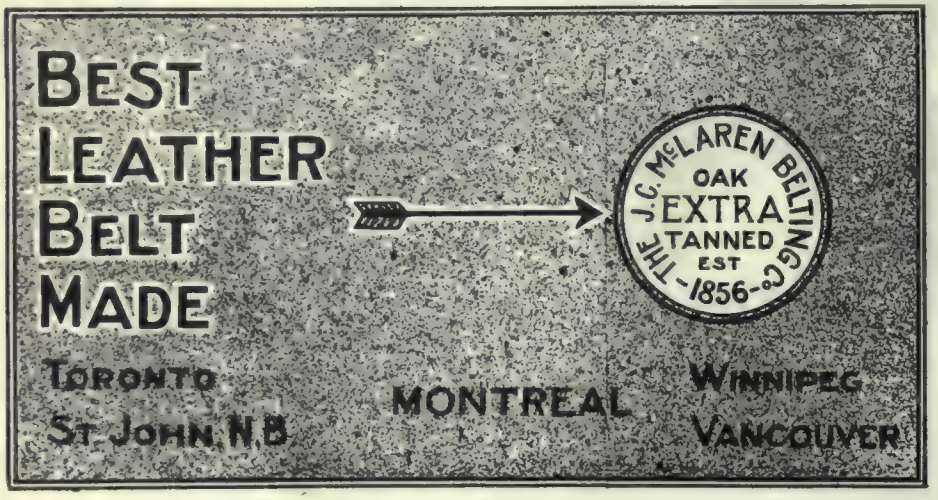


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**John Morrow Screw & Nut Co., Limited, Ingersoll**

Co., the McKinnon Holmes Co., and the Canadian Rand Co.

**Ingersoll, Ont.**—The Motor Truck Co. are asking for a loan of $10,000 from the town to assist them in establishing a factory here. It is the intention of the company to have a plant and equipment within one year, valued at $20,000.

**St. John, N.B.**—Incorporation has been granted the Maritime Nail Co., head office in St. John. They are capitalized at $250,000. The incorporators are: S. E. Elkin, F. E. Marvin, E. C. Elkin, H. A. Marvin and C. P. Nixon, all of St. John.

**New Westminster, B.C.**—It has been reported from Coquitlam that the Schaake Machine Works, of this city, will be transferred there, if negotiations now under way are satisfactorily completed.

**Weyburn, Sask.**—The building now nearing completion and which will be used by Acton & Montgomery as a garage and machine shop, has been added to considerably, making room for additional business.

**Cornwall, Ont.**—There has been a movement on foot here to amalgamate the two foundries in Cornwall, De Rochie Bros, and J. Miller & Co. The joint stock company propose erecting a machine shop 50x100 feet and enlarging the foundry. They also contemplate adding a malleable iron plant.

**Port Arthur, Ont.**—It has been reported that the Rhodes-Currie Car Co. will establish a car plant between here and Fort William.

**Galt, Ont.**—The Canada Machinery Corporation, Ltd., has taken over the London Tool Works, of Hamilton. The corporation head office is located here.

**Regina, Sask.**—The Winnipeg Steel Granary & Culvert Co. are doubling the floor space of their factory here, and have also installed several more machines to enable them to keep pace with their increasing business.

**Regina, Sask.**—The Minneapolis Steel & Machinery Co. of Canada, have secured a warehouse here to look after the needs of the Prairie Provinces.

**Vancouver, B.C.**—The International Lead & Iron Co. will erect, this spring, in the vicinity of Spokane, a plant for the manufacture of pig iron and cast iron pipe.

**Belleville, Ont.**—The United Motor Car Co., which will manufacture automobiles in Canada to use the Augustine rotary engine, propose establishing a plant here to cost approximately $175,000.

**Medicine Hat, Alta.**—The Alberta Rolling Mills are adding a 50x100 shipping warehouse to their present plant here. A number of additional rollers will also be added in the near future.

**Moose Jaw, Sask.**—The Rumley Co., one of the largest manufacturers of threshing machinery, have decided to locate here, and will erect a warehouse early this spring.

**Wingham, Ont.**—The Western Foundry Co. have decided to instal a central power plant and generate their own electricity to operate both their immense plants, which will occupy ten acres of land.

**Owen Sound, Ont.**—The ratepayers will vote on two industrial by-laws on March 9, one to expend $1,500,000 for a shipbuilding and dry docking plant.

### MUNICIPAL.

**Moose Jaw, Sask.**—The city council is advertising for tenders for an elevated water tank. It will have a capacity of 75,000 gallons.

**Vancouver, B. C.**—The ratepayers have authorized the following expenditures: Sewers and permanent improvements, D. L. 301, $90,000; acquisition of paving plant, $100,000; Seymour waterworks extensions, $350,000; and general waterworks extensions, $275,000.

**North Vancouver, B.C.**—The ratepayers passed the following by-laws: Waterworks loan, $125,000; Rice lake reservoir, $75,000.

**Edmonton, Alta.**—The city proposes spending the following amounts: Street railway, $602,006.67; water filters, $29,686.66; waterworks building, $9,733.33; city warehouse and workshop, $5,353.34.

**Vernon, B.C.**—The city council passed a by-law to provide $12,000 for sewerage extensions.

**Victoria, B.C.**—The citizens approved the letting of a contract to bring in a new water supply from Sooke Lake. This involves an expenditure of approximately $1,200,000.

**Toronto, Ont.**—The city will ask the Ontario Legislature for authority to issue debentures without a vote of the people to the amount of $100,000 to cover the expenses in connection with repairs and extension of the intake pipe.

**Biggar, Sask.**—The municipality is taking steps to borrow $9,000 for road grading, tools and machinery.

**Ormstown, Ont.**—A by-law providing for sewerage and waterworks is being prepared for the ratepayers.

**Edmonton, Alta.**—The city is taking steps to instal a municipal gas plant.

**Burnaby, B.C.**—The ratepayers have carried the by-law providing $250,000 for a waterworks system.

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They are designed, built and priced for the small man, the man with limited capital, who, none the less, must have accurate and well-made tools.

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It is a husky, *good* tool and its price is kept low by its lacking appearance, finish, etc., and in no other way.

**SPECIFICATION**

Height of centres, 6 in. to 9 in.
Length of bed, 4 ft., 6 in.
Diameter of work admitted over bed - - - 12½ in. to 18½ in.
Diameter of work admitted over saddle - - - 9 in. to 15 in.
Length between centres - - - 2 ft. 9 in.
Weight - - - - 780 lbs.
Fitted with either treadle or countershaft for power.

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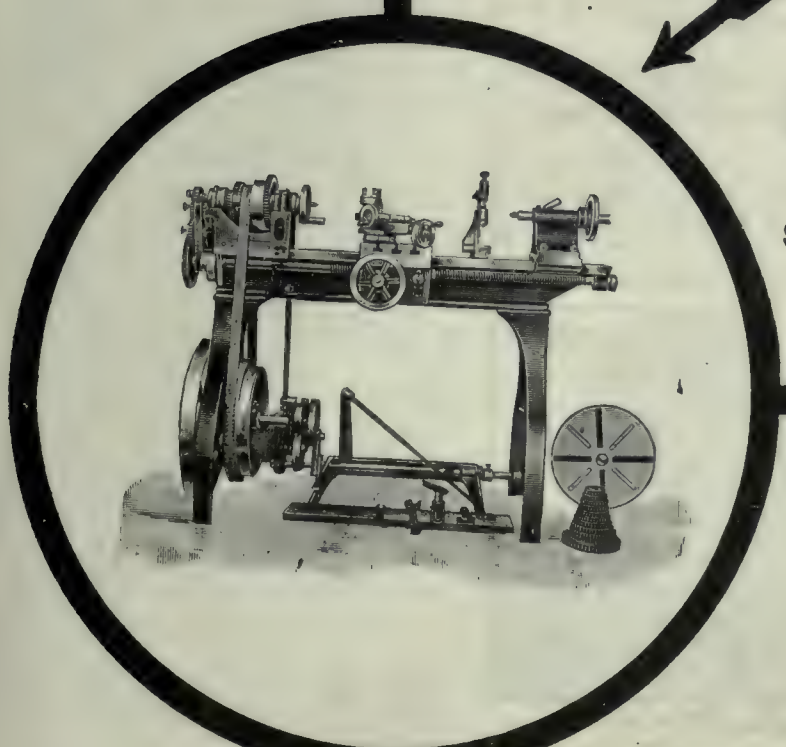

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**Victoria, B.C.**—The ratepayers have authorized an expenditure of $200,000 for the waterworks and $450,000 for sewers.

**London, Ont.**—The city is applying to the Legislature for power to borrow the following amounts: $5,000 for a weigh scales and public convenience; $50,000 for an incinerator and plant, and $57,000 for extending the waterworks system.

**Sarnia, Ont.**—It is proposed to remove the Sarnia waterworks to the lake shore.

**St. Thomas, Ont.**—The council has been discussing the proposal to renovate the local street railway system. The report of the experts regarding the municipal heating plans are also being considered. By-laws covering these improvements will likely be submitted to the ratepayers in the near future.

**Parry Sound, Ont.**—The ratepayers carried the Standard Chemical, Iron and Lumber Co. by-law by a substantial majority. It calls for a bonus of $25,000 by way of loan.

**Kamloops, B.C.**—The ratepayers have authorized an expenditure of $60,000 for an auxiliary steam plant and a new reservoir.

**Stettler, Alta.**—Stettler proposes to expend $1,107,280 for the purpose of establishing a sewerage system.

**Calgary, Alta.**—Steps are being taken to prepare plans for a sewerage disposal plant here.

**Port Stanley, Ont.**—The Port proposes to expend $22,000 for a waterworks system.

### ELECTRICAL.

**Calgary, Alta.**—The city proposes to expend $368,000 extending the light and power system.

**Barrie, Ont.**—The town will seek power to issue $80,000 debentures to construct a pole line to the Simcoe Power Company's plant.

**Edmonton, Alta.**—The city will expend $200,000 for power plant improvements, and $275,000 for telephone extensions.

**Toronto, Ont.**—The city has applied for power to authorize an expenditure of $2,200,000 to equip an electric power plant.

**Orillia, Ont.**—The town will apply to the Legislature for power to borrow $80,000 for power purposes.

**London, Ont.**—The city will apply to the Legislature for power to raise $90,000 for electric light extensions.

**Edmonton, Alta.**—The city proposes to expend $62,780 for lighting purposes.

**Kamloops, B.C.**—The ratepayers defeated the $300,000 hydro-electric by-law.

### GENERAL MANUFACTURING.

**Windsor, Ont.**—The Frederick K. Stearns & Co. have decided to erect a $25,000 addition to their plant here. Plans are in the hands of Crane & Pennington, architects, of this city.

**Thorold, Ont.**—James Battle is promoting a company which proposes to establish a $1,000,000 paper plant here. The new industry will employ about 150 men.

**Highgate, Ont.**—The British-Canadian Canners have decided to erect a big cannery here, at a cost of $45,000.

**Woodstock, Ont.**—The Sanitary Manufacturing Co. have been incorporated and will locate a factory here. They will manufacture filters, refrigerators, woodenware, furniture, carpet sweepers, vacuum cleaners, etc.

**Halifax, N.S.**—The Nova Scotia Knitting Co., of Eureka, N.S., has passed into the hands of J. C. McIntosh & Co., of Halifax. The plant will be enlarged with $25,000 worth of new knitting machinery.

**Niagara Falls, Ont.**—The Sanitary Packing Co., of Toronto, is erecting a large factory half way between Queenstown and Niagara-on-the-Lake.

**Souris, Man.**—The business of the Arnett Furniture, Ltd., has ben sold to a new company, who will make a specialty of office and store fixtures.

**Galt, Ont.**—A number of local capitalists will establish a brick industry here to use the Berg process. A $40,000 plant will be erected. W. B. Shaw is the superintendent.

**New Toronto, Ont.**—The T. N. Firth & Sons Co. will establish a large factory here. Building operations will commence in the near future.

**Portage la Prairie, Man.**—The pump factory here, owned by H. J. Hughes, was badly gutted by fire recently. The woodworking machinery was badly damaged.

**St. John, N.B.**—The Royal Block Powder Co., of Portland (Me.), have definitely decided to erect a blockite factory here. They will build seven buildings, each 60x40 feet by 30 feet high. Construction will begin this spring.

**Blairmore, Alta.**—The Keystone Portland Cement Co. will establish a big industry here and have purchased the Frank Smelter and the Blairmore brick plant. The machinery of the new plant will be driven by individual motors.

**Wallaceburg, Ont.**—The Dominion Carlite Explosive Co.'s plant was destroyed by fire recently.

**Moose Jaw, Sask.**—The Robin Hood Flour Mills have decided to re-build in this city. A flour mill of concrete and a separate breakfast food mill, with elevators and modern power house, will be erected as soon as possible.

**Vancouver, B.C.**—F. A. Bean, of the International Milling Co., owning mills in Minnesota, Iowa and Moose Jaw, visited Port Mann

vators, and a 5,000-barrel flour mill. Construction will start in 1913.

**Brantford, Ont.**—The plant of of the Brantford Roofing Co. will be greatly enlarged this year.

**Niagara Falls, Ont.**—The Urschel Bates Valve Bag Co., of Toledo, Ohio, will establish a branch factory here at once. It will give employment to 75 men.

**Windsor, Ont.**—The city is to have a new industry to be known as the Canadian Gas Co., capitalized at $1,000,000.

**St. John, N.B.**—The Consolidated Pulp & Paper Co., capitalized at $5,000,000, will erect a big paper mill here. They have taken over the Gibson lumber properties, at a cost of $2,000,000. The new mill will be located near the pulp mill at Fairville.

**Lethbridge, Alta.**—The Canadian Swift Co. will establish a $75,000 plant here. A warehouse, cold storage plant, and general wholesale headquarters will be built.

**Medicine Hat, Alta.**—Mr. MacIntyre is promoting a company to manufacture porcelain ware of every description, dishes, jugs, etc. They propose to locate a $40,000 plant here.

**Saskatoon, Sask.**—The Saskatchewan Manufacturers & Contractors, Ltd., propose erecting a factory here. They will manufacture an exclusive line of fireproof building material.

**Moose Jaw, Sask.**—The Western Manufacturing Co. will establish here the largest and best equipped woodworking factory in the Prairie Provinces.

**Dartmouth, N.S.**—The Nova Scotia Carriage Co., now operating in Kentville, N.S., propose establishing in this place. They propose installing $50,000 worth of modern machinery.

**Lethbridge, Alta.**—The Martin Trunk Co., of Picton, Ont., propose establishing a $40,000 trunk factory here.

**Ottawa, Ont.**—The British American Bank Note Co. will erect a $75,000 building here. The plans have been approved.

### BUILDING NOTES.

**Vancouver, B.C.**—Sullivan & Considine, of the Orpheum theatre, will erect a ten-storey office block here to front the theatre. The improvements will represent an expenditure of $350,000.

**Saskatoon, Sask.**—David Webster, architect, has prepared plans for a $75,000 office building here.

**Vancouver, B.C.**—A syndicate, headed by J. Coughlan & Son, propose erecting a $600,000 building here. It will be eighteen storeys high.

**Toronto, Ont.**—It is rumored that Sir Rodolphe Forget contemplates establishing a fifteen-storey building here at the corner of King and Yonge. The project has not yet been confirmed.

**Vancouver, B.C.**—The British Columbia Auxiliary Canadian Bible Society will erect a $112,000 ten-storey building here.

**Vancouver, B.C.**—Another ten-storey building, to be known as the Grossman building, will be erected here, at a cost of $500,000. It is being financed by Abram Grossman.

**Toronto, Ont.**—Plans have been prepared for the new Technical School, which will cost approximately $900,000. It will be the best equipped in the world.

**Montreal, Que.**—J. O. Gravel has taken out a permit for a ten-storey building, to cost $136,000. It will be erected at the corner of Notre Dame and St. Sulpice Streets.

**Port Arthur, Ont.**—The supplementary estimates brought down in the Federal House contain an appropriation of $65,000 for an armory and drill hall here, and a like amount for Fort William.

**Vancouver, B.C.**—Henry Birks & Sons will erect a ten-storey store and office building here next summer. The total cost will be $200,000.

### TRADE NOTES.

**The H. W. Johns-Manville Company,** already well known in the lighting field by reason of their J.-M. Linolite System of Illumination, have acquired the sole selling agency for the entire products of I. P. Frink. An engineering department will be maintained along very extensive lines. This department will maintain a corps of engineers throughout the United States and Canada, and be equipped to place data and recommendations in the hands of all interested in any subject pertaining to illumination.

**Schumacher & Boye,** Cincinnati, manufacturers of engine lathes, have been succeeded by the Boye & Emmes Machine Tool Co. The change was brought about by Mr. Boye and Mr. Emmes purchasing the interest of Mr. E. A. Schumacher in the firm of Schumacher & Boye. Mr. Emmes has been with the old firm for about fourteen years and had full charge of the shops during that period. He is well and favorably known to the trade.

**The Vulcan Engineering Sales Company** has been organized and incorporated with offices in the Fisher Building, Chicago, and 30 Church street, New York. The company controls the entire product and will handle all sales of


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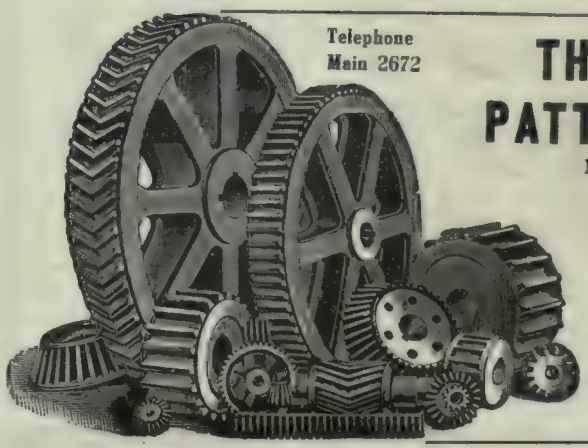

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the Hanna Engineering Works of Chicago, Mumford Molding Machine Company, of Plainfield, N.J., and O. M. S. Company, of New York. Further factory arrangements are under way and the Vulcan Company will own and manufacture a number of railway special tools and equipment for shop and maintenance departments. The officers are: H. K. Gilbert, President, formerly vice-president of the Buda Company, and P. W. Gates, Secretary and Treasurer, now President of Hanna Engineering Works, formerly president of Gates Iron Works. E. H. Mumford, now Vice-President and General Manager of Mumford Molding Machine Company, will continue in the same position and duties as heretofore and William L. Laib, Vice-President and Secretary of the Hanna Engineering Works, will continue in his present position with that company.

**Robey & Company, Ltd., Lincoln, England,** Manufacturers of high speed enclosed engines, air compressors, mining, stone crushing and coal conveying machinery, are putting their lines on the Canadian market. Their Canadian business will be in the hands of Mr. Alf. J. Jones, A.M.I. Mech. E., an engineer of wide experience and practical knowledge. Mr. Jones will also handle electrical machinery manufactured by Crompton & Co., Ltd.; wood working machinery of Roscam & Co., Ltd., as well as the paraffin heavy fuel and speed engines made by Chas. Price & Son.

**The Engineers' Representative Co.,** with offices at 201 Board of Trade Building, has been formed just recently. The manager is Robt. Holmes and the sales manager P. O. G. Janes. This firm will act as agents for firms having engineering, machine shop and power house supplies and equipment of all kinds. Both men are practically and technically trained engineers of wide experience and will no doubt be in a position to handle successfully any work which they may undertake. The agencies they will carry are not yet decided upon, but they are in negotiation with several first-class firms.

**A. H. Winter Joyner, Ltd., 76 Bay St., Toronto,** report having had a good year in 1911, and state that the prospects for 1912 are excellent. They hold the sole Canadian agency for the Helios Mfg. Co., Philadelphia, Pa., and have recently completed an installation of the latter company's flame arc lamps (25 cycle) at the Western Cattle Market, Toronto, where they are giving excellent satisfaction. The firm are also representatives for the Pemco street lighting fixtures and at present have a contract on hand for installing the same at Berlin, Ont. Other firms represented by the A. H. Winter Joyner, Ltd., are the Western Electric Instrument Co., Newark, N.J., whose instruments the Toronto Hydro-Electric use exclusively, and the Bristol Co., Waterbury, Conn., the well-known makers of pyrometers and recording instruments of all kinds.

### FOUNDRY AND MACHINE SHOPS.

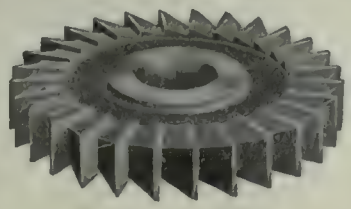
**Galt, Ont.**—Sheldons, Ltd., will build next summer an entirely new foundry covering an area of 110x200 feet. Two cupolas will be installed and also electric cranes. The company will also extend their machine shop up to the limits of their present property.

### BOOK REVIEWS.

An interesting and valuable contribution to the ball bearing literature of the present year is the Engineering Edition of catalog-treatise, issued by The New Departure Mfg. Co., of Bristol, Conn. This is fresh from the press, contains seventy-six (76) pages, and has been prepared by the company's staff of ball bearing specialists and engineers. It gives valuable information of a technical character, and is fully illustrated by fine engravings. Typographically the book is a product of the American Lithograph Co., of New York city, and creditably reflects the skill of that house in modern high grade catalogue work. The New Departure Mfg. Co. offer to send this catalogue on request to manufacturers, purchasing agents, designing and mechanical engineers, and other responsible persons who are interested. We suggest that such requests be made on the letter head of the firm with which they are connected. Address The New Departure Mfg. Co., Bristol, Conn.

### CATALOGUES RECEIVED.

**The Cleveland Twist Drill Co. have issued** an attractive little folder calling attention to the recent extraordinary feat performed by a 1¼-inch "Paragon" high speed drill in drilling through cast iron at the rate of 57½ inches per minute. The folder is artistically printed in colors, the inside showing reproductions of the leading technical papers which published particulars of the above performance. Amongst these, Canadian Machinery occupies a prominent position.



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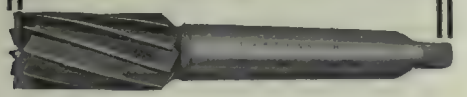

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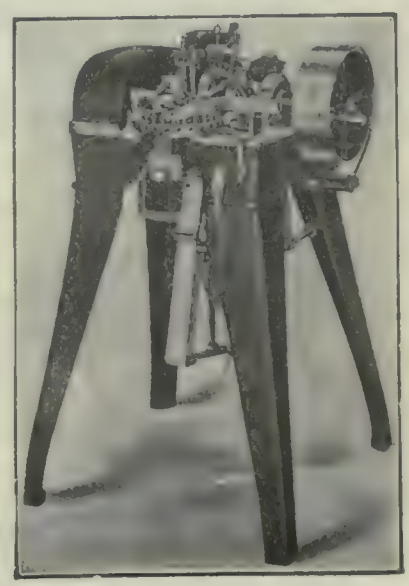

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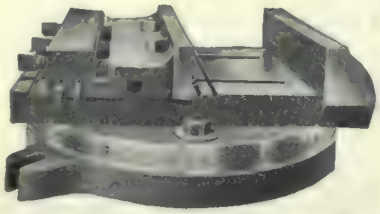
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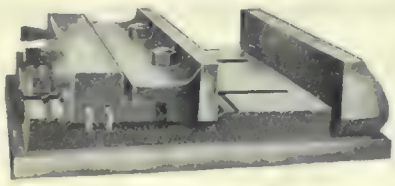
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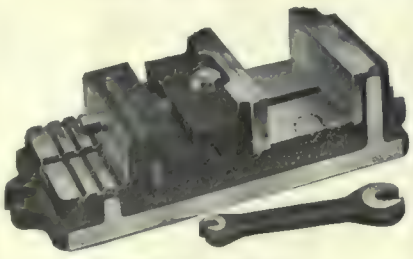
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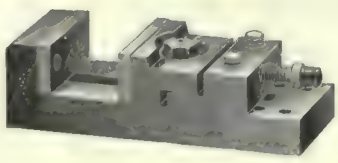
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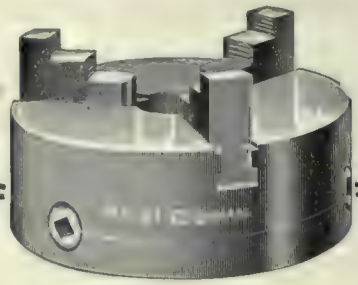

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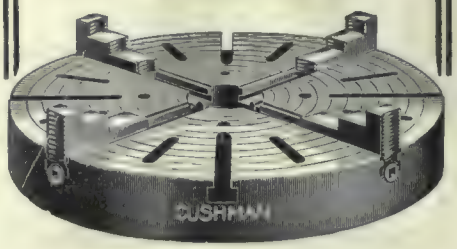


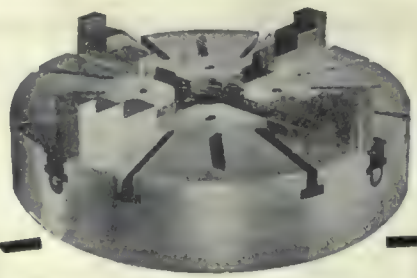

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# Prominent Features of Forge Practice in English Shops

By Joseph Horner

*The writer is well and favorably known through his contributions to the editorial columns of the leading technical journals of Great Britain and the United States. Concerning Canada, he is no stranger, having on previous occasions furnished highly instructive information to readers of Canadian Machinery on important developments in mechanical engineering practice. The subject of the present series of articles will be found extremely interesting, enabling, as it does, a close comparison between British and Canadian methods to be made, and perhaps profitable hints extracted.*

TO talk about forge practice involves dealing with classes of work which are as highly differentiated as are heavy marine engine castings and small brass castings; or as the work of the heavy turnery and machine shop, and that of the automatics. There is little in common between the methods of production of massive forgings and those of small dimensions, while forgings of medium size form another class apart from the others. The methods suitable for one great group are not available for the others.

Outside this general classification, there is in each much scope for variation in methods, and in selection of machines and appliances. A great deal of hand-forged work is still done in general engineering shops when the volume of repetitive work is not seemed sufficient to render the cost of stamping dies remunerative. There is a large quantity of this in which but a few similar forgings are wanted, and when these are of fair dimensions, little help can be derived from the use of dies except for those sectional parts of the work which would occupy the most time in finishing on the anvil.

These dies may then be kept as a constantly growing stock outfit, both with a view to lessen labor, and to impart rapid finish to forms which are identical in different jobs. Eyes for tie-rods are very common examples, also valve bridles, levers of many shapes and so on; bosses and webs being the ever-recurring shapes. In such cases, the forgings or portions of them are often prepared roughly at the anvil and finished only in dies. More frequently, the power hammer is used for roughing down with setts, fullers, flatters, punches, etc.; these latter being especially handled or prepared for the purpose. Special spring swages and tools may also be used, and by taking another heat, the final correction and neat finish are imparted in the die or dies. These are frequently of cast-iron, because easily and cheaply made, or of cast steel. They are not always attached to the anvil or the tup, but often simply placed on the former, with or without strap attachments to prevent them from shifting. If there is a top die it may be located on the bottom one by means of dowells or guide strips. Alternatively, it may be attached to the tup.

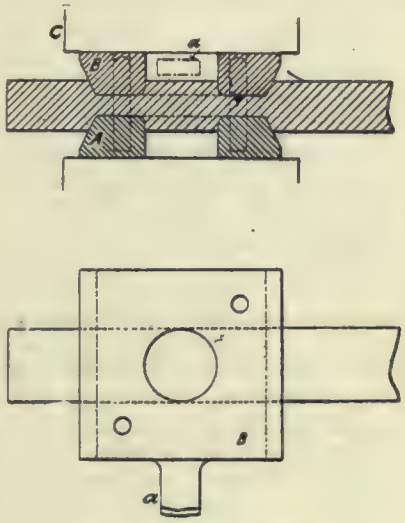
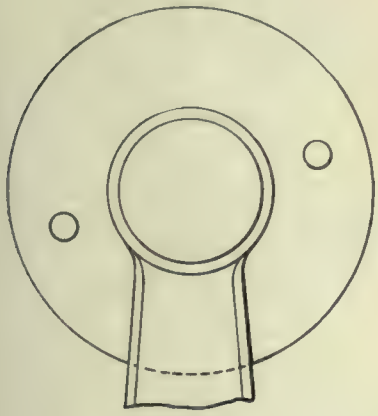



Fig. 1—Forge Practice.



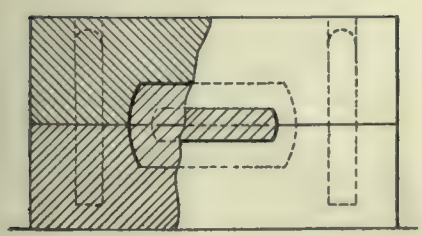
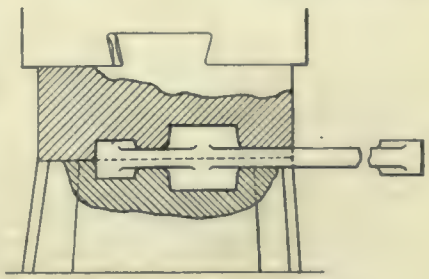


Fig. 2—Forge Practice.

In almost all English engineers' smithies, these dies accumulate in large numbers, yet they are the only real economical aids which can be utilized, apart from a heavy outlay which would not be justified by the numbers of similar forgings required. They save much laborious correction with swages and flatters, and ensure uniformity of dimensions as well as the neat finish of identical parts. The work turned out in these shops with the assistance of cast-iron and steel dies is thus usually that of finishing only. A few examples will represent the largest proportion of this class of work done in English engineers' smithies.

### Examples of Dies.

Fig. 1 is an example of a couple of simple dies used for finishing the circular portions of bosses on opposite sides of a lever. The lower die A, merely lies on the anvil; the upper one, B, being gripped by a long handle A, centred by holes dropping over dowells, and driven down by the tup "C." Both dies are steel forgings, their holes being bored. This is representative of a large quantity of work in which a bar or an odd chunk of suitable cross section is fullered down under the power hammer. Corners are cut with a hot sett, when bosses, bossed ends, or forked ends have to be produced. Drawing down of webs and stems is done on suitable setting



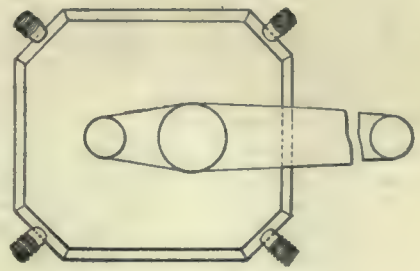
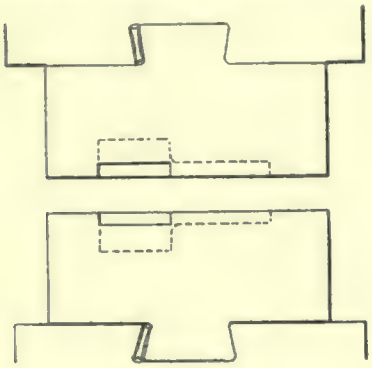


Fig. 3—Forge Practice.

blocks with hammer blows. With another heat, the finish is imparted between dies made in designs suitable to the requirements for bosses, stems and lumps for forked ends, and for punching holes and recesses. The drawing down which is done under the hammer directly need not be illustrated. It is done with or without preliminary fullering. The fuller used may be either a spring or top fuller. The forging or only sections of it are put into dies for the corrective and finishing operations.

If a top die is not attached to the tup it is usually essential to dowell it to the bottom block, without which precaution the bosses on opposite sides of



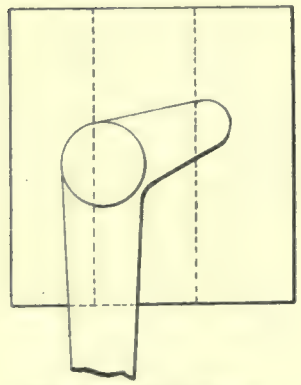
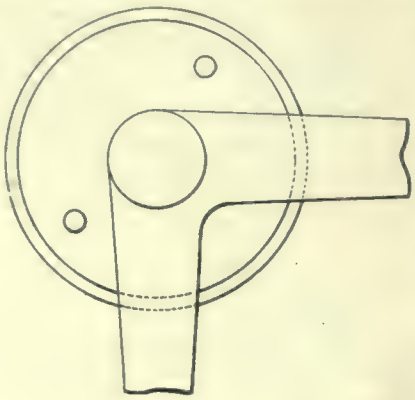


Fig. 4—Forge Practice.

the web are likely to get out of alignment. The dowells should be in the lower portion to avoid the filling up of the holes with the scale and dust from the forgings. The dies not only finish the bosses but also portions of the web which lie adjacent. This is usually all that is done in the dies; the main portion of the web of a long lever being finished away from the dies, directly between the tup and anvil.

A bossed end is shown as finished in a pair of steel dies, Fig. 2. The bottom die is simply laid on the anvil, the top one dowelled to it and gripped by a pair of special hoop tongs. Fig. 3 is a pair of steel dies finishing two adjacent bosses on a lever; done thus because they are close enough together to be treated in the die. The boss at the outside end is finished in a separate die. The bottom die in this example is held on to the



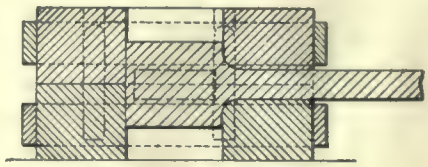


Fig. 5—Forge Practice.

anvil with the usual four poppet screws employed on drop hammers, by means of which it can be brought exactly in alignment with the top die and held with a dovetail and wedge in the tup. In the finishing of webs, some drawing down is inevitable, and its amount must be estimated correctly beforehand, when bosses are situated at both ends, or when their centres will not come right. These may be checked with a fixed trammel, or by rule measurement as the work is proceeding.

Fig. 4 is an example of steel dies attached to tup and anvil, and finishing the bent portion of a lever, including its boss; the opposite end being treated in another die. Fig. 5, illustrates cast iron dies also finishing a bent lever previously roughed out at forge or hammer. The bottom die lies on the anvil; the

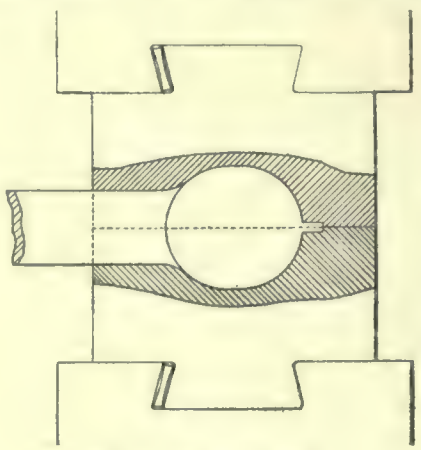
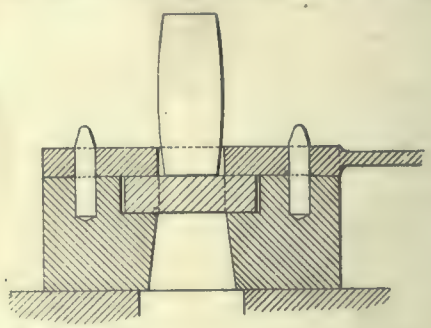


Fig. 6—Forge Practice

top one being dowelled to it, lifted off and on with the special hoop tongs already mentioned. The top die is struck by the tup.

When levers are set at angles, this is not done by stamping the angle in the die as would be usual in small drop forged work; levers like those in Figs. 4 and 5, being commonly forged straight and bent under the tup. One end is gripped edgewise between the anvil, and the tup brought down lightly on it; and the free over-hanging end being then set with sledge with or without the help of a setting block, after which the lever is put into the dies as shown, for final correction and finish.

In the engineer's smithy two pairs of dies are often used for articles of similar shape, though smaller work of simi-



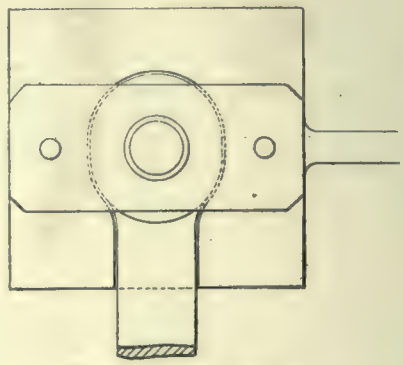


Fig. 7—Forge Practice.

lar kind would, when made in the regular stamping shops be forged at one operation. Thus, Figs. 6 and 7 show the two stages of making the eye of a tie-rod, which, when finished is welded to the straight bar. The welding length of stem is drawn down from a bar of about the same cross-section as that of the eye, and the eye itself is roughly trimmed by cutting off the corners with a hot sett. It is then finished to shape in the dies, Fig. 6, the surplus metal passing partly into the stem, partly into a recess made in the dies and partly as a fin into the joints; provision for receiving which may or may not be made. The fin having been knocked off, the eye is dropped into the bottom die, Fig. 7, and the punching templet for the eye laid on; being centred by its dowell

holes. The punch is then placed and driven through by the hammer. The eye metal is mostly pushed out as a burr, but a little extension of the eye takes place laterally, allowance for which is provided by making the die rather larger than the eye when first inserted as indicated.

In this class of forging, little trouble is experienced from the presence of fins

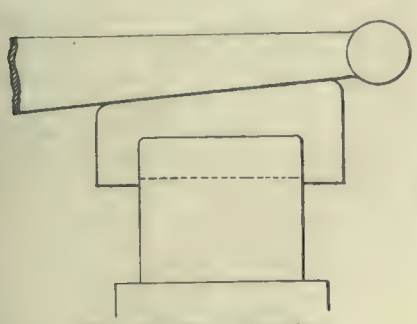


Fig. 10—Forge Practice.

which are thrown out so extensively in drop forging work. Stripping dies are, therefore, seldom used, and any fin that may form is generally cut off with a hot sett. Punching is usually done with a loose punch in this kind of work, although in regular die-stamping shops, handling small forgings, the punches are made solidly with the dies.

Fig. 8 illustrates another example of punching, that of a square hole. Oblong or elliptical holes are quite as readily made. In this case instead of the loose guide-plate put on the flush-topped die of Fig. 7, the top die becomes a guide for the punch. The punches are either bellied or straight tapered, both forms being used at the forge and anvil. The hole in the bottom die is tapered to permit of free delivery of the burr, and the depth must be sufficient to give it clearance below the forging.

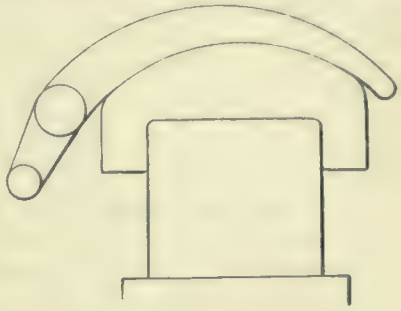
In Fig. 8, the dies are of steel and a handle is welded on the top one for lifting purposes. In Fig. 9, and also in Fig. 5, cast-iron dies are shown. In these, one handle, or two, when considerable weight has to be lifted, are frequently cast in. As these project awkwardly, an alternative is to core holes in their ends for the insertion of loose handles, Fig. 9. Cast-iron dies should in almost all cases be bonded. Cast-steel dies, unbonded, are frequently substituted, but the working parts come out rougher and require more trimming than do those of cast-iron. The bonds are made and shrunk on hot, but are liable to shift in consequence of the jar of the hammer blows; hence, the outsides of the dies are sometimes tapered slightly so as to be larger in the portions towards which the bonds tend to shift.

Fig. 10 illustrates how the tapered portions of webs, etc., are finished with a loose block laid in another block on the anvil. Blocks of different angles can be substituted. Fig. 11 shows a curved lever similarly set on a curved block. In article II. the practice of die stamping shops will be considered.

# Abrasive Wheels

By J. H. Williams.

WHILE the art of making abrasive wheels is not a new one, it is only of recent years that the various processes have been worked out on a scientific basis, and the importance of the grain



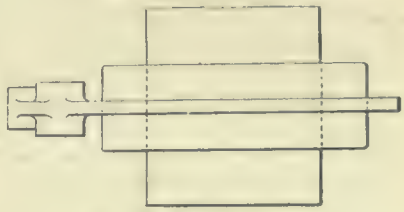


Fig. 11—Forge Practice.

and grade in relation to the speed of the wheel and the work to be performed fully understood. Manufacturers, however, are now realising that it is a saving of both time and money to use wheels of the very best quality, running at the

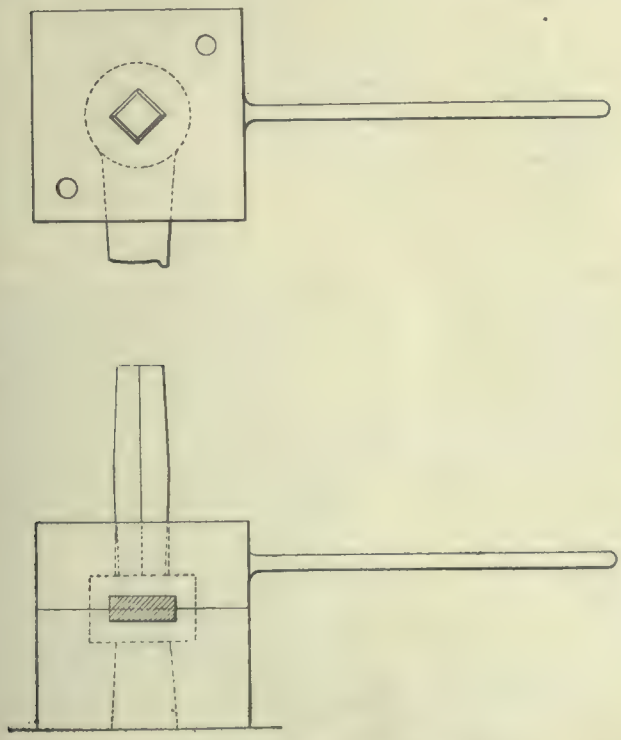


Fig. 8—Forge Practice.

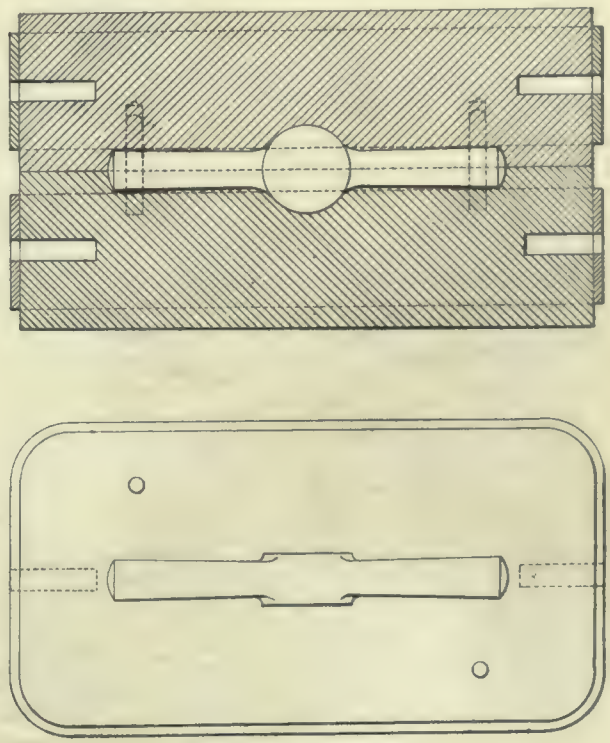


Fig. 9—Forge Practice.

correct speed on machines of heavy and substantial construction. Occasionally factories are seen where wheels of the same size may be running on various machines with a difference in speed of 50 per cent. or more, and with a corresponding difference in durability and efficiency. Since most makers of abrasive wheels now grade their product so as to give the best results at a peripheral speed of from 5,000 to 5,500 feet per minute, it can be readily seen that if run at half that speed, the wheels will do less work and wear out much faster than if properly speeded, even if made of good material by the best process.

**The Ideal Wheel.**

It has been said that the ideal wheel should contain only cutting materials. The only wheel that can fulfill this condition is the vitrified wheel, the bond of which will cut by itself, without the addition of emery or other abrasive material. Probably 85 or 90 per cent. of the wheels now used are made by the vitrified process. All other processes, such as the silicate process, are substantially alike; the emery grains being combined with some binding material of an adhesive or gummy nature, such as shellac, rubber, asphaltum, celluloid, silicate of soda, etc. The mass is tamped or pounded in an iron mould, and is afterwards dried or baked in an oven at a low heat. Most tamped wheels require the addition of a certain amount of corundum or other brittle material to secure the desired cutting qualities.

**Vitrified Wheel Manufacture.**

Vitrified wheels require no tamping or pounding. The emery grains are mixed with various vitreous clays and spars, the amount of which, in proportion to the emery, determines the grade of hardness of the finished wheel. Water is added and the mixture stirred until of the proper consistency, when it is poured into rings of sheet iron, no tamping being employed. The sheet iron rings or hoops stand on slabs of plaster of Paris which rapidly absorb the surplus moisture in the mixture. The wheels are allowed to partially dry and are then placed on a special machine having a horizontal revolving table and a flat-nosed tool which travels parallel to the latter. On this machine the wheels are shaved down to approximately the correct diameter and thickness. They are then taken to an oven or drying room where they remain until absolutely dry. After careful packing in clay saggers in the kilns, the latter are fired, the temperature gradually rising to about 2,500 degrees Fahrenheit. This great heat fuses and vitrifies the clays and spars, which on cooling form the bond that holds the grains together. The kilns, after firing, are very slowly cooled down; the process taking several days, depending on the size of the kiln. When cool, the wheels are put in a face lathe and dressed perfectly true all over. The holes for the arbors are then brushed with lead to the proper size.

The wheels are next placed on a special testing machine consisting often of an ordinary double floor fitted with wood-lined steel boxes, in the which the wheels revolve, thus eliminating all danger of damage should a wheel burst. By means of a variable speed motor or by a system of several countershafts, the spindle of the machine is given a wide range of speeds, all wheels, no matter what their diameter, being tested to run at a peripheral speed of not less than 9,000 feet per minute, which gives a stress of 250 lbs. per square inch. When run at the usual speeds of from 5,000 to 6,000 feet per minute the stress on the wheel is from 75 lbs. to 100 lbs. per square inch, so that this test gives an ample factor of safety. Having successfully passed the test the wheels are carefully inspected and are then ready for boxing and shipment.

**Points to be Noted.**

When ordering abrasive wheels, the purchaser should give the manufacturer all the information possible as to what the wheels are expected to grind and under what conditions. To many this may seem unnecessary; but to the maker of the wheel it is important. It is to his interest to suit his customer's requirements; and while some prefer a hard wheel with a long life, others find it more economical to use a softer, quicker-cutting wheel. Any preference in this matter should be mentioned at the time of ordering.

When once a satisfactory grain and grade for any particular class of work has been established, a good manufacturer should be able to reproduce it indefinitely. As a general rule, the harder the metal to be cut, the softer the grade of the wheel, on account of the tendency to pull the grains from the bond. However, it is economical to use a grade that will get out the work in the shortest possible time, since the labor cost is higher than the wheel cost.

A wheel that quickly glazes, and so requires constant dressing, is manifestly too hard and will prove expensive in the end, since it is worn out by the dresser instead of by the work.

**General Observations.**

Complaint is sometimes made by users that a wheel is softer at the centre than at the rim. This is obviously impossible with a vitrified wheel, which is not tamped. The true explanation is that when the wheel is worn down it is not running at its proper peripheral speed and does not cut so freely. Hence the impression is given that it is soft at the centre. Where practicable, wheels should be changed, when worn, to a faster running machine, so that their surface speed may remain approximately constant. A good vitrified wheel is not affected by heat, cold or water. In fact, water increases grinding production, and when grinding tools, should always be used. If it is necessary to keep the work and machine from rusting, soda water may be used.

It is becoming more and more widely recognized that the abrasive wheel is a "cutting" wheel and not a "grinding" wheel. Its action is analagous to that of a milling cutter with thousands of fine pitched teeth. This should be borne in mind, and the wheel given proper attention in order that the greatest efficiency may be got out of it.

## POWER COSTS.

THE following statement shows the cost of power in a number of prominent Canadian cities. It was embodied in a report made by a special Board of Trade Committee from data secured through investigation:

**Toronto**—Hydraulic; 92 miles; light, 8c. to 3c., with discount of 10 per cent.; power, 5c. to ½c., with discount of 10 to 20 per cent.

**Hamilton**—Hyraulic; 32 miles; light, 2¼c., discount, 10 per cent.; installation free, power, $1.20 per h.p. per month.

**Calgary**—Steam and hydraulic; 35 miles; light, 9c., discount 15 per cent.; power, 2c. to 1 1-10, with discount of 10 per cent.

**Winnipeg**—Hydraulic; 37 miles; light, 7½c., now 3c.; power, 4c. to 1c.

**Edmonton**—Steam coal, $3 a ton; light, 8c.; power, 8c. to 3½c.

**London**—Steam and hydraulic; 150 miles; coal at $3 a ton; light, 4½c.; power, 3½c. to 1¼c. with discount of 10 per cent.

**Vancouver**—Steam and hydraulic; 17 miles; light, 11c. to 4c.; with discount of 20 per cent.; power, minimum charge of 2c.

**Victoria**—Steam and hydraulic; light, 13c. to 9c.; with discount of 1c per kilo-watt; power, 7c. to 2c.

**Hamilton**—Coal, $3 per ton; gas, $1.00 per 1,000.

**Calgary**—Coal, $2.62½ to $4 ton; gas, $1.75 to $1.35 per 1,000.

**Winnipeg**—Coal, $3.50 per ton; gas, $1.30 per 1,000; discount 10 and 25 per cent.

**London**—Coal, $3 per ton; gas, 95c. per 1,000.

**Vancouver**—Coal, $3.75 per ton; gas (a), $2 per 1,000, discount 25 per cent. (b), $1.50 to $1.25, discount 10 per cent.

**Victoria**—Coal, $3.75 per ton; gas (a), $2 per 1,000; (b), $2 to $1.50, discount 25c.

# The Big River Lumber Co. Plant, Big River, Saskatchewan

By Allen Norgrove.

*This plant, although located away back in the woods, as it were, is of the most modern type for its purpose, being laid out for convenience and flexibility, with reserve equipment to avoid stoppage or extended delay and inconvenience through accident or breakdown. A careful perusal of the various features will be found edifying to operators and manufacturers alike, showing as it does the wisdom of a proper initial installation for a given duty.*

THE power-house, a brick building 80 x 152 feet, lies north of the sawmill and is covered with galvanized corrugated iron roofing. It is divided by a brick wall running lengthwise, forming on the east side the engine room and on the west side the boiler room.

### The Boiler Room.

This contains twelve horizontal tubular boilers 18 feet by 72 inches, built by the Muskegon Boiler Works, Muskegon, Mich. There is space left for two more boilers, should it be necessary to install them. The boilers are hung in the usual way to strong steel "I" beams resting on steel posts, which, in turn, rest on a concrete foundation. They are set in pairs in Ashley steel casings, which give a neat appearance, none of the brick-work being visible. One stack connects each pair of boilers, its dimensions being 4 ft. diam. x 100 ft. high above the breaching.

Each boiler is connected through a 6-in. pipe long radius bend to a 30-inch header, from which one 12-inch line leads to No. 1 engine, one 10-inch line to No. 2 engine, one 5-inch line to No. 3 engine, two 8-inch lines into sawmill, one 4-inch line to boiler feed pumps, one 6-inch line to fire pump, a 4-inch line to the big whistle, and a few smaller lines for sawdust conveyer engine, flue blowers, etc. The boilers are also equipped with "Dutch oven" furnaces, having 8 x 6-ft. grates for burning sawdust, shavings, etc. The latter are brought in from the mill by a steel chain conveyor, which runs through fire-room, and what is not consumed in the furnaces is carried over to the fuel house, at the north end of the power-house, by the same conveyor.

When the sawmill is shut down, or not supplying enough fuel, return is made from the fuel-house by a second

Big River Lumber Co.—Refuse Burner

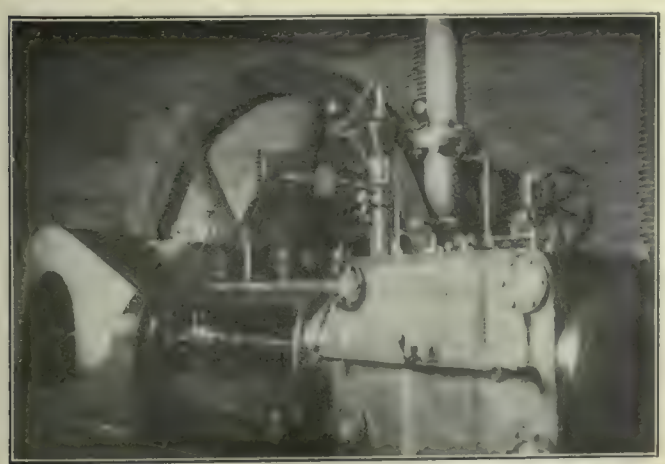
steel conveyor, driven through a "Jewel" high-speed automatic engine placed on the steel floor of boiler-room, which is level with the oven tops and engine-room floor. Under this steel floor a track is laid for wood supply and taking out ashes, etc. Each boiler has two blow-off valves, a Crane blow-off valve next to boiler, and an asbestos-packed cock outside of this, both being inside fire-room. Each boiler has a separate blow-off pipe leading to the river bank, about 70 feet away.

### Engine Room.

The engine room contains three simple Corliss engines of the double eccentric, long range cut-off type, built by Filer & Stowell, Milwaukee, Wis. No. 1 is a 38 x 60 inches cylinder, running 61 rev. per minute, with flywheel 24 feet diameter, 68-inch face. This engine drives the sawmill with a 66-inch leather belt 145 feet long, supplied by the Beardmore Belting Co. Toronto. In case the engine should get on centre, it is fitted with barring-over cylinders. These consist of a cylinder placed on each side, near the rim of the wheel. On the cross-head end of the piston-rod is a grip which holds the rim, and lifts it the length of the stroke of the cylinder—about two feet. When reversed, it lets go, sliding down the rim until piston reaches the bottom cylinder again, ready to repeat the same operation. The cylinders are fitted with piston valves for ease of operating, and cushion is obtained by valve and port construction, as in loading and turning cylinders in sawmills. By having one cylinder on each side of wheel, it matters not to which side the belt runs, as one cylinder is large enough alone.

### No. 2 Engine.

No. 2 engine has a 30 x 48 inches cylinder, and runs 100 rev. per minute. It is direct connected to a Crocker-Wheeler alternator of 1,000 k.v.a., 600 volts, 3-phase, 60 cycle. This engine furnishes power for planing mill, machine shop, etc.



Big River Lumber Co.—16-in. x 30-in. Engine.

Big River Lumber Co.—30-in. x 48-in. Engine.

**No. 3 Engine.**

No. 3 engine has a 16 x 30 inches cylinder, and runs 120 revs. per minute. It is direct-connected to another Crocker-Wheeler, 3-phase, 600-volt, 60-cycle generator of 150 k.v.a. This engine carries the lights and a few small motors; in fact, it takes care of the load up to its capacity, at which point it is taken over by the 30 x 49 inch cylinder engine.

For town lighting, current at 600 volts is carried by a line running at right angles to the streets; a transformer placed on each street supplying a 110-volt circuit, on to which the house circuits are tapped. This system works very well, as none of the streets are long, and no difficulty is found in keeping the circuits balanced.

The other engine room equipment consists of a 2,500-h.p. "Wainwright" derwriter pump, situated on river at water's edge for fire protection. Its 8-inch discharge comes through basement, and is connected so that it can feed direct to boilers in case all three boiler feed pumps should by any means become disabled. The boiler feed pumps are arranged to discharge into the fire line, each of them having a separate suction to the river. They can feed the boilers either through the heater, or

Big River Lumber Co.—Saw Mill from Town Site.

Big River Lumber Co.—Saw Mill Looking from River.

**Switchboard.**

The switchboard is of finest blue Vermont marble, and consists of eight panels: one for measuring instruments for each machine, and which consist of ampere-metre for each phase, voltmeter, ampere and voltmeters for exciters. The exciter switches, and rheostats are also on the same panels. One panel carries the main switch and relay for each machine, and the other four are for distributing circuits. The switchboard stands out about four feet from wall, thereby allowing current, potential, transformers, oil switches and all fuses to be placed behind it. Current at 110 volts is used for lighting, and that used in power house and sawmill is transformed inside of power house by three single-phase transformers in engine room.

closed feed water-heater, a large oil filter, and the heating coils required to keep the room at the temperature at which the oil will flow. The oil flows by gravity from filter to engines, then to a tank in basement, from which it is pumped to the filter again, thus keeping down the oil bill.

**Basement.**

The basement contains the feed-water pumps, and all the valves for controlling the heating, water and drainage for the whole plant.

This is a necessity in such a severe climate (60 degress below zero), as the frost goes down in the ground more than eight feet. The boiler feed pumps consist of three Filer & Stowell duplex pumps of the Worthington type, 10 x 6 x 10, with 5-inch suction, 4-inch discharge. There is also a Fairbanks un-

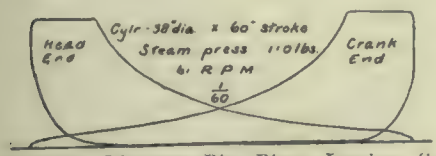
direct, and any one of them can be turned into any line independently. There is a tee on the suction pipe near pumps, where hot water from the huge refuse burner can be turned in with a head of 75 feet.

The suctions to the boiler feed pumps and discharge from fire pump come up through a concrete tunnel into the basement. Live steam to fire pump, the exhaust from boiler feed pumps, drains from header, water columns, and heating systems pass out again through this same tunnel, thereby keeping the water pipes from freezing, and maintaining open water for fire pump intake. This is only 10 feet from the pump, and makes an easy lift. All pumps are fitted with Mason regulators. The branches from the water line are all taken off the main in basement, the largest one sup-

Bird's Eye View of the Town of Big River.

Big River Lumber Co., Rafts of Logs in Front of the Mill.

plying the sawmill service. This is an 8-inch line from which branches lead out to 24-hose-gate valves located in and around the mill. There are two 50-foot lengths of hose and a nozzle in rack close by each. Another 8-inch line leads up town, with hydrants and hose to protect planing mill, and a feed line to refuse burner. All lines are carefully laid out so that any one of them can be shut off and drained in the basement. This layout cost a large sum to install, as it required many valves to

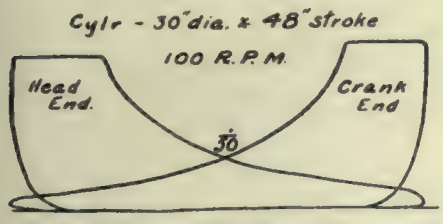



Indicator Diagram—Big River Lumber Co. engine.

secure the necessary service and control.

**Exhaust Piping.**

The exhaust piping is laid out with the like precautions to save a shutdown, a tee being used under each engine cylinder, one side of which is piped outside with a back pressure valve, the other side being piped to the feed-water heater line, with a gate valve for each engine. This line is of 14 inches spiral riveted galvanized pipe, and can either be made to pass through feed-water heater or by-passed through sawmill to hot pond. This pipe also collects all drains from the steam feed cylinders, as well as from some of the smaller cylinders in sawmill. The log deck cylinders, which consist of 6 cylinders for log turners, 3 cylinders for loaders, and 3 cylinders for log kickers, have a separate 5-inch exhaust line, also leading to the pond. As steam sett-works are used on the carriages, steam guides and




Indicator Diagram—Big River Lumber Co. engine—Back pressure valve open.

straining devices on the band-mills, and steam cylinders for raising skids and bumpers (in all 42 steam cylinders in sawmill), there is quite a quantity of exhaust and drains to be taken care of.

A 6-inch line off main exhaust before it enters heater leads to heating coils in sawmill, from whence a 3-inch line leads to the planing mill. About 2 pounds pressure is carried during day time, and about 4 pounds during night time. This is obtained by using a 14-inch back pressure valve on the exhaust line. The planing mill is heated by placing coils between the machines at places best suited, the machines producing the necessary circulation. The sawmill has coils and a fan placed in room on north side of the building. Air is drawn in by the fan through the coils, and then forced out through light galvanized iron piping of 4-ft. diameter at fan, reducing to 6 inches at smallest outlet.

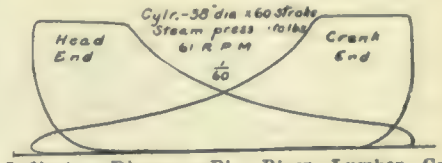
**Refuse Burner.**

The refuse burner stands north of the sawmill in front of power house. It is a large iron structure, 34 feet inside diameter, 140 high, with an 18-inch water space for 75 feet of its height. It has a large opening on side next mill for refuse conveyor to empty its contents, and on the opposite side a smaller one for shavings from planing mill. It stands on a concrete and firebrick foundation, and the water space is fed by four 3-inch water pipes at bottom and one 3-inch pipe up near conveyor opening. Four 4-inch pipes serve for the overflows, which are carried to hot pond by an 8-inch line. A 6-inch line is taken from near the middle of its height to suction of boiler feed pumps. This is taken up inside near the top, then through the shell and down the outside, with vent at highest point inside to prevent syphoning. A double screen is provided on top for arresting sparks, and a flare is placed at top of outer sheet of water-jacket to catch water when boiling, and return it into water space. All necessary man and hand holes are provided for cleaning out, also doors for regulating draught and cleaning bars through burner proper, beside doors for cleaning out ashes and regulating draught below bars. This outfit was by the Muskegon Boiler Works.

**Sawmill.**

This is a large frame building on cement footings, 273 x 125 ft., with lath-mill on one side, 32 x 127 ft., and lumber sorting shed and transfer platforms, 118 x 296 ft., on the other. It contains three bandmills and carriages (with 12-inch steam feed cylinders), one vertical and one horizontal re-saw, four edgers, two sets of trimmers, all the necessary live rolls and chains for automatically moving lumber from one machine to the next, until boards are loaded on cars ready for the piling ground; also, log chains for bringing in the logs; steam cylinders for loading, turning, etc. The mill has a capacity of from 3,800 to 4,000 logs per day of 10 hours. In addition, there is a large slasher for preparing slabs for lath mill. The lath mill is capable of turning out about 90,000 per day of 10 hours.

Above the main floor of the mill is the filing room, where all the saws are sharpened, tempered, brazed, and worked up to cutting shape. This room has its own engine, so that it may be run independently. Below is the basement, which contains all shafting, belts, pulleys, friction clutches, steam cylinders, and piping, etc., for driving machinery, besides all chains and conveyors for carrying away sawdust and refuse. In the basement, also, are work benches, tool rooms, racks for oil cans, and the belt room. In this latter place, belts are made up and repaired, it being eq-



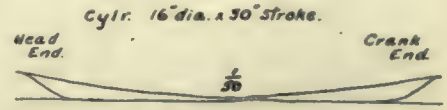

Indicator Diagram—Big River Lumber Co. engine.

uipped with a full line of tools for cutting, scraping, glueing, riveting, etc.

**Planing Mill.**

This is a frame building, 209 x 100 ft., situated about 350 feet away from sawmill, with C. N. R. tracks running alongside. It contains 10 planers, 1 moulder, 1 edger, 2 trim-saws, 1 table saw, and 2 re-saws. Overhead is the filing room, where all the saws are kept in cutting trim, and at one end is the grinding room, where all the knives are sharpened and shaped.

It is equipped with Sheldon's (Galt) patent blower system for gathering up shavings and delivering same to fuel house. By this system, shavings and sawdust are collected by two 75 h.p. motor fans, having pipes to each machine and other parts of the building where shavings fall. Delivery is into a large separator, the air passing out through the top, while the shavings fall to the bottom and pass into a machine with revolving cylinders open at each end. These, in turn, come under the separator, and fill with shavings, then




Indicator Diagram—Friction load—Big River Lumber Co. engine.

under the pressure pipe of a large rotary blower. At the same time the other end of cylinder is directly over discharge pipe leading to fuel house. This pipe is 13 inches diameter, and is fitted with a valve and branch pipe to refuse burner, when shavings are not needed for fuel. The power equipment in planing mill, including back heads for planers, filing, grinding rooms, and blower system, consists of 28 Crocker-Wheeler motors, ranging all the way from 75 h.p. to 10 h.p.

### Machine Shop.

The machine shop is a large building situated about 300 feet from sawmill. It contains one large planer, 36 inches x 16 feet; one large and one small lathe, shaper, nut and bolt machine, power hack-saw, drill presses, tyre bender, pipe cutting and threading machine, etc. There is a blacksmith's shop adjoining. The machine shop is driven by a 50 h.p. motor, and the blacksmith's shop is equipped with a small motor-fan for blowing fires.

### Round-house.

There is a round-house for steam log haulers, containing a locomotive-type boiler, a Marsh pump, and the usual equipment for washing out and repairs. A blacksmith shop is also attached.

### Manufacturers of Equipment.

All the sawmill machinery was supplied by Filer & Stowell Co., Milwaukee, Wis. Boilers and burner by the Muskegon Boiler Works Co., Muskegon, Mich.; piping and valves by the Canadian Fairbanks Co. and the General Supply Co., both of Winnipeg; belting by the Beardmore Belting Co., Toronto, through the General Supply Co., Winnipeg. Planing mill machinery was all supplied by the Berlin Machine Works Hamilton, Ont., together with Sheldon's patent blower system. All the electrical equipment was supplied by the Canadian Crocker-Wheeler Co., St. Catharines, Ont.

### Big River Township.

The town is situated east of plant, on high ground, the streets running north and south. It is well governed, clean and sanitary, with comfortable dwellings. There is a large boarding house, butcher's shop, post-office, railway station, schoolhouse, hospital, two churches, main office, a large retail store, and a big wholesale warehouse, with spur into same from main track. This latter institution is a necessity, as there are 25 lumber camps to be served besides the town. The population numbers between 800 and 900, while large numbers are continually going to and from the camps.

The town, with its stores, offices, churches, schoolhouse, etc., as also the sawmill, planing mill, and all machinery therein, the boarding house, lumber yards, tracks, etc., were carefully planned, laid out and erected under the supervision of Mr. W. A. Graham, the present superintendent. There are two mail and passenger trains per week, in addition to freight and supply trains. The company owns a gasoline car, which plies between Big River and Prince Albert.

## GEORGIAN BAY CANAL.

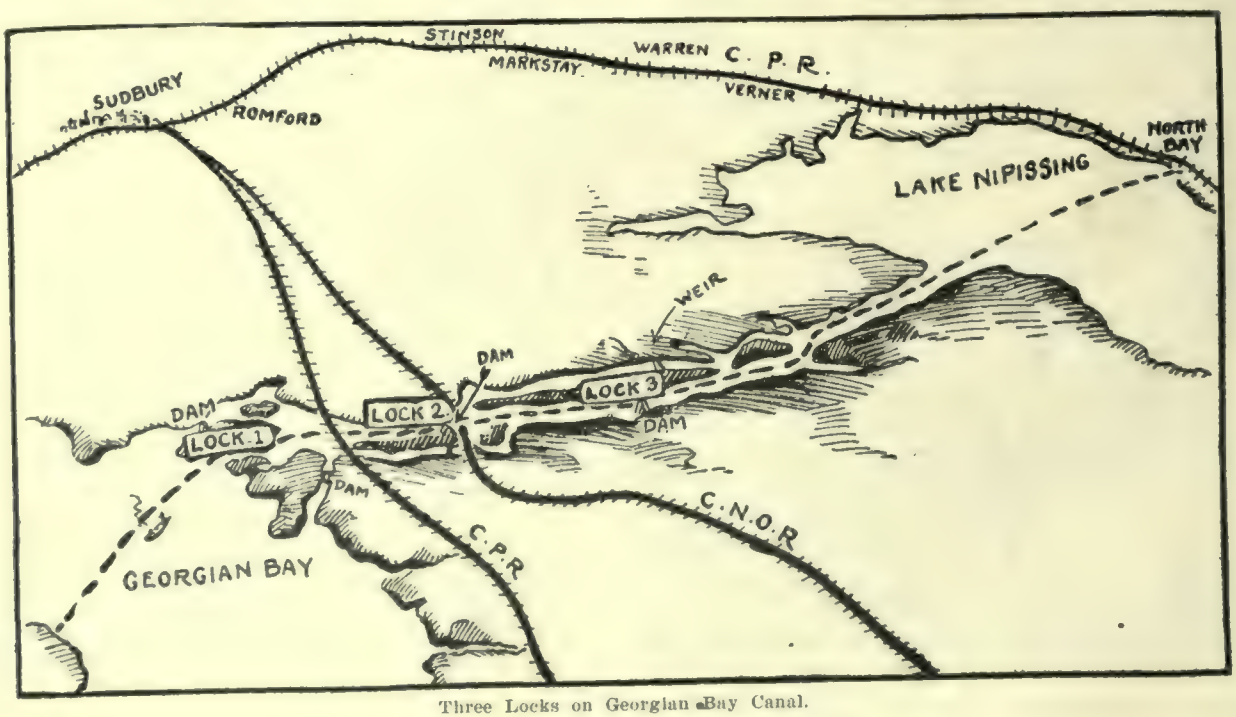
OUR illustration of the French River from the Georgian Bay to Lake Nipissing was that recently submitted to the Federal Government at Ottawa. A deputation from the Ottawa Valley urged the Cabinet to begin work on the French River section of the Georgian Bay canal. The diagram illustrates what the northern people want, and why. The citizens of North Bay are particularly interested in the project, and they are supported by the Associated Boards of Trade of Ontario in the request to make navigable the 49 miles from the Georgian Bay to Lake Nipising. Should the undertaking be carried out, North Bay, the gateway of New Ontario, would become a grain depot, being favorably situated on the C. P. R.; while the T. & N. O. line from the G. T. P. and the C. N. R. will come in from the east. It is estimated that 35,000 horse power can be developed from the locks in the French River stretch of the proposed canal.

## STEEL CAR PLANT AT PORT ARTHUR.

Eastern Canada financiers and manufacturers, headed by F. B. McCurdy, J. R. McLeod and F. M. Brown recently signed an agreement with the City of Port Arthur for the erection of a modern steel and wood car plant, with a capitalization of $5,000,000. These people are organizers of the Nova Scotia Car Company, Limited, which is operating successfully in Halifax. The company will employ 1,000 men, and as the plant is located at the head of navigation and the centre of Canada, it will be in a position to supply freight and passenger cars to the various transcontinental railways at the points where most needed.

Chas. H. MacMillan, general superintendent of the Dominion Steel Co., has resigned. He has been connected with the steel plant as superintendent for five years. It is not known who will succeed him.

George Smith, who has been superintendent of the steel foundry department of the Londonderry Iron & Mining Co., Nova Scotia, has resigned to assume the position of superintendent of the Dutcher Works plant of the Prince Steel Co. Milwaukee, Wis.




Three Locks on Georgian Bay Canal.

# DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

## AUTOMATIC STARTING CONTROL.

### Gould & Eberhardt Motor Driven Crank Shaper.

THE machine illustrated is a 24-inch Gould & Eberhardt crank shaper, driven by a five h.p. Reliance adjustable speed motor of the armature shifting type, with a speed range of 300 to 1,500 r.p.m. It is equipped with automatic starting control and Reliance speed dial.

#### Speed Changes

Speed adjustments with the Reliance adjustable speed motor of the armature shifting type are obtained by the mechanical shifting of the motor armature. This is controlled by the hand wheel A, on the equipment illustrated. Turning this hand wheel causes quick, but smooth changes in the cutting speed. With the speed properly set for a given operation, the motor may be stopped and started as often as desired without further attention to the speed adjustment. This is possible with the armature shifting type of motor due to the fact that the starting and stopping is entirely separate from the speed control.

#### Cutting Strokes.

By using a motor with a speed range equal to the ratio of the back gear, an unbroken range of cutting strokes is obtained from 4½ to 115. The unlimited number of cutting strokes throughout this wide range combined with ample power at all speeds insures maximum output for any size cut on any kind of material.

#### Starting and Stopping.

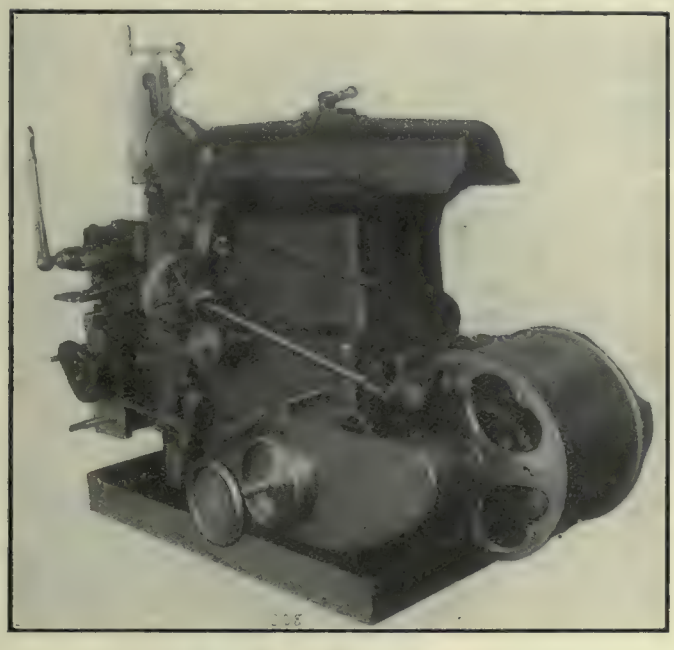
The starting and stopping of the motor are controlled by an automatic starter through the drum switch, B. This switch has three points: start, off and brake. To start the motor, it is simply necessary for the operator to throw the switch to the starting position When the switch is thrown to the "off" position, the power is shut off and the time taken for the machine to stop will depend upon the time required for friction to overcome the momentum of the moving parts.

When the switch is thrown to the brake position, the motor is automatically brought to a stop almost instantly. This simple and positive method of stopping eliminates the necessity of a clutch, which, it will be noted, is not used on the shaper illustrated. With this method, the motor is never running idle, thus unnecessarily wasting power. The starter is of the series control type, and automatically takes care of all starting conditions. It removes all possibility of abuse to the motor or starting equipment. The starter itself is mounted on a nearby post. All wires are carried in conduit tapped directly into the drum switch, thus, doing away entirely with exposed wiring and contacts about the machine.

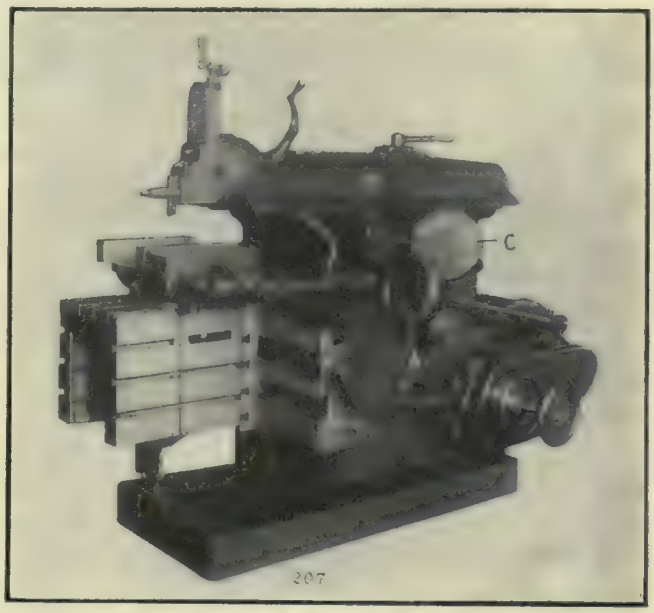
#### Reliance Speed Dial.

The Reliance speed dial C is a device which permits of instantly setting the motor speed to give any desired speed at the cutting tool. It is of the nature of a circular slide rule, and in the case of a shaper takes account of all the variable factors, such as ratio of drive, length of stroke and cutting speed desired.

The method of using the dial is exceedingly simple. Assuming, on the shaper illustrated, that it is desired to take a cut of 40 feet a minute with a stroke of 20 inches. The small knurl on the front of the dial is turned until the indicator which moves about the top scale is opposite 40; this being the desired cutting speed in feet per minute. The motor armature is then adjusted by turning the hand wheel A until the pointer of the dial is opposite 20, which is the stroke to be used. The dial not only serves as a guide in setting the speed accurately, but is always in plain sight as a definite indication to the foreman or inspector of the speeds in use by the operator.



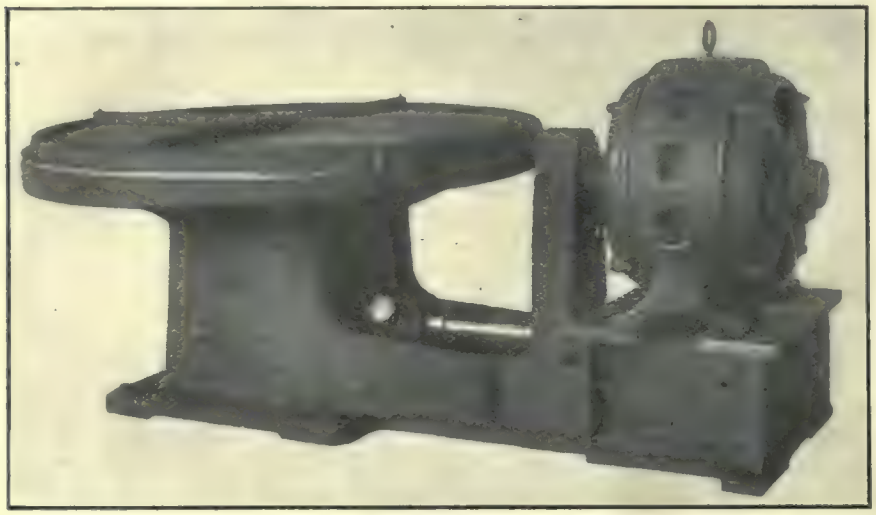
Motor Driven Crank Shaper.




Motor Driven Crank Shaper.

## MOTOR DRIVEN VERTICAL SPINDLE DISC GRINDER.

THE accompanying cut shows a new motor driven disc grinder recently put on the market by the Gardner Machine Co., Beloit, Wis. The machine is their large vertical spindle type, with 53-inch diameter disc wheel. The feature illustrated is the arrangement for direct connected motor drive.



Motor Driven, Vertical Spindle Disc Grinder.

A 15 h p. motor mounted on pedestal at the right hand end drives the main shaft of machine by silent chain. The shaft drives disc wheel spindle through bevel gears, which are fully enclosed and run immersed in oil. The motor pedestal is made in different sizes to accommodate various makes of motors. A guard covers chain and gears. The starting box is attached to rear base of machine, but does not show in cut. When these machines are installed in plants having no dust exhaust system, an exhaust blower is furnished; the driving pulley for same being attached to a driving shaft midway between shaft collar and silent chain gear. The disc wheel is driven at 500 r.p.m., and the complete machine weight is 4,500 lbs. These grinders are made in the same size for overhead or underbelt drive; the motor driven type being often found more convenient when it is desired to place machine under a hoist or craneway. Such a location is convenient, as the work done by these No. 24 machines is generally of a large and heavy nature

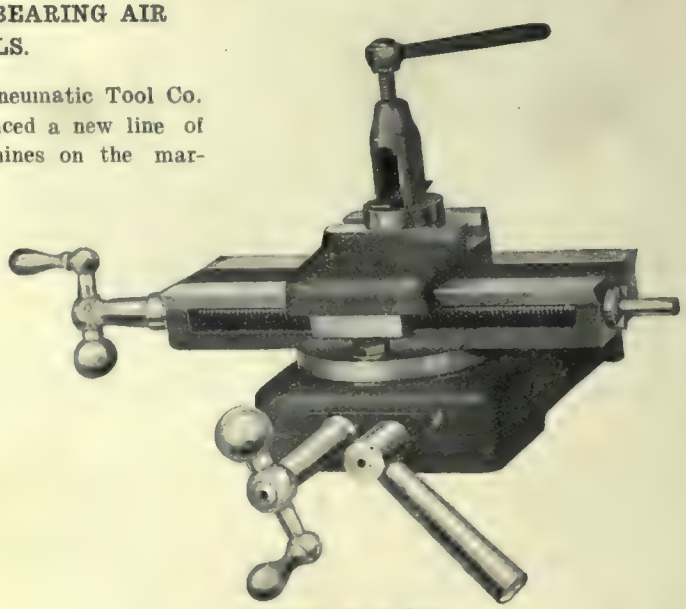
## THOR ROLLER BEARING AIR DRILLS.

THE Independent Pneumatic Tool Co. have recently placed a new line of portable drilling machines on the market, known as the Thor Roller Bearing Piston Air Drills. These machines possess the same general features which were used so successfully in former types of Thor drills, such as corliss valves, telescopic screw-feed, removable crank chamber plate, and large air chamber. The size of the spindle in most cases has been increased, but the most radical improvement is in the crank shaft bearings, connecting rods, eccentrics and eccentric straps. The crank shaft has been greatly strengthened, and anti-friction roller bearings are provided for same. The rollers are of ample length and diameter and are retained in a machine brass cage. The bushings have a slip fit into the casing and are hardened and ground. The crank shaft has rounded ends and end thrust against a hardened plate which reduces friction.

On account of the increased size of the crank shaft, and ample size of rollers, the centre bearing is dispensed with. The eccentric is smaller in diameter, and being mounted on the crank shaft, still further reduces friction. The toggle and connecting rod used in former types has been replaced with a one-piece connecting rod, similar to that used so successfully in the Thor Nos. 8 and 9 close corner drills. Roller bearings are also provided for the idler or planet gears in the compound drills, and an improved shifter mechanism is used on all two-speed machines.

The accompanying illustration shows this drill with roller bearings on each end of the crank shaft and one-piece connecting rod. These tools are made by the Independent Pneumatic Tool Co., Chicago, whose Canadian representatives are, H. W. Petrie, Toronto, Montreal and Vancouver.

Thor Roller Bearing Air Drill.



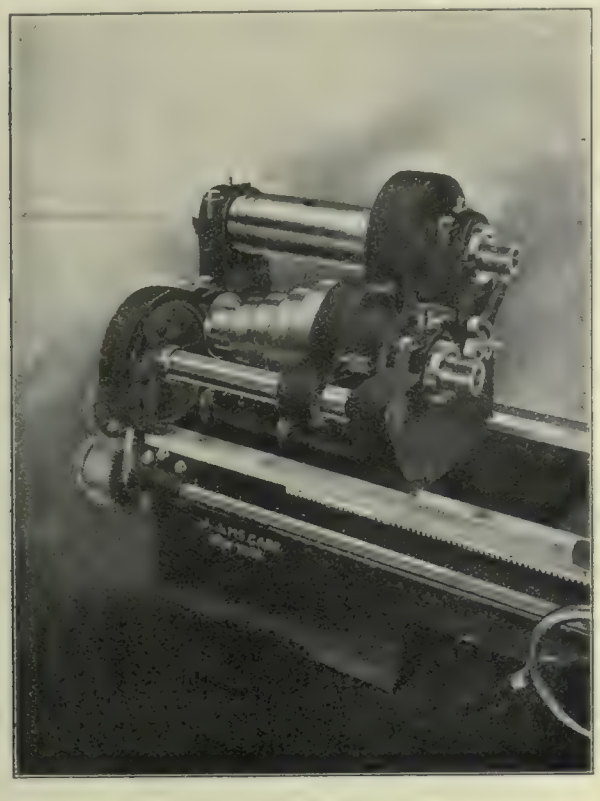
Improved Slide Rest.

## BLOUNT IMPROVED SLIDE REST.

THERE is described and illustrated herewith the new Improved Slide Rest manufactured by the J. G. Blount Co., Everett, Mass., for use in connection with their 11-inch swing lathes. This rest embodies all the up-to-date features of such a tool, being so designed that both the cross and lateral feed screws are not exposed to chips and dirt. The handle for the lateral feed screw is detachable and may be used on either end. The graduated swivel is located between the

upper and lower slide, being held in position by two tee bolts, which is the method used on an engine lathe carriage.

The rest, held rigidly to the lathe bed by an eccentric clamping device, which is a distinctive feature of the Blount line, has a lateral feed of 7½ inches, a cross feed of 5½ inches, takes tools 7-16 by ¾ inch, and will allow a piece of work 7½ inches diameter to swing over it.



Two-in-one Double Spindle Lathe.

## TWO-IN-ONE DOUBLE SPINDLE LATHE.

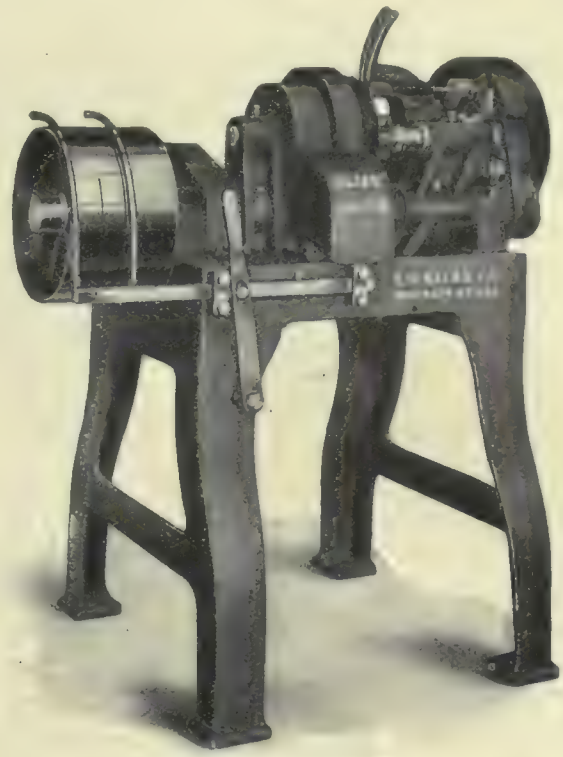
THE many improvements and added features to be noted on the McCabe two-in-one double spindle lathe, have increased its popularity among manufacturing and repair machine shops generally. This particular tool combines the capacity of a triple-geared 4¾-inch swing (geared 72 to 1) and that of a 26-inch back-geared lathe. To accommodate the standard gauge of locomotive drivers, the swing of the large lathe has recently been increased to 54 inches, and that of the small lathe to 32 inches. Steel cut gears are used throughout while the design and constructional detail are such as to cope with the severest high speed duty service. All parts are duplicated and made interchangeable; this type machine being the firm's one speciality, which is made in large lots at a time. The builders are J. J. McCabe, Hudson Terminal, 30 Church street, New York City.

## AUTOMATIC THREAD ROLLING MACHINE.

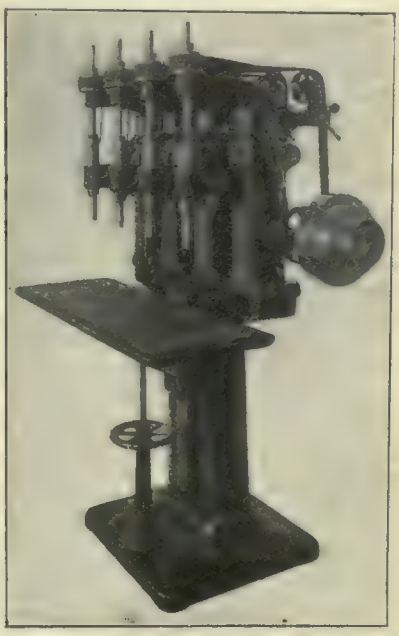
THIS illustration represents a new type Automatic Threading Machine recently designed and built by the E. W. Bliss Co., of Brooklyn, N.Y. It has been designed especially for rolling threads on long drawn shells of small diameter and comparatively light stock.

The machine has four spindles revolving in a horizontal turret, the turret being revolved intermittently by a Geneva movement and the spindles continuously by spur gearing. The spindles are successively brought into position for the various operations; the first or upper one being in front of the feed tube, where the shell is pushed in and on to the chuck; the second is in front of the thread rolling chuck, the third or lower one is the unscrewing device which consists of two leather covered rolls held by spring pressure against the shell, and revolving in a direction to unscrew and discharge it when finished. The chucks are made so that the drawn shell just fits over the thread before rolling. The fourth position is idle, after which the chuck returns to the feed tube again.

In threading, the chuck is so supported as to prevent springing, thus insuring a perfect thread throughout the entire shell length. The machine takes tubes up to 1-inch diameter by 1¾ inches high, and has a capacity of 80,000 in ten hours; it being only necessary to drop the shells in the feed tube.



Automatic Thread Rolling Machine.



Automatic Feed for Drilling Machines.

## AUTOMATIC FEEDS FOR DRILLING MACHINES.

THE Dwight Slate Machine Co., Hartford, Conn., have recently put on the market a multiple spindle drilling machine embodying some unique features in automatic feed and releasing devices. The machine is equipped with either of two feeding mechanisms, one of which is actuated by cam and the other by worm and gear.

The cam driven feed machine is de-

signed particularly for the drilling of small and medium size repetition work that can be rapidly and conveniently exchanged in fixtures and jigs. To further increase the output of the machine, the cams are not keyed in line on the feed shaft. In a four spindle machine they would be keyed on the quarter or at 90 degrees. This arangement results in feeding the spindles in progressive order.

Thus, due to the fact that each feed is controlled by cam, the feed return is automatic, and the idle time for exchange of work is practically eliminated. The feed shaft is driven through a change gear box which provides for three speeds of feed for each of three spindle speeds. Through a series of levers, which constitute the automatic release and safety devices, the cam operates a spur pinion which meshes into a rack attached to the spindle. One revolution of the cam is the factor which limits the throw of the feed arm, and consequently the depth to which a hole can be drilled. This limit is 1½ inches for the four-spindle machine in the accompanying cut. The automatic safety device is attached to all spindles and acts independently on each. An increase pressure at the drill point will automatically throw out the feed. Rapid and convenient adjustment for various sized drills is provided. To a great extent this eliminates the amount of breakage of twist drills.

Each spindle has an independent endless belt drive. The adjustment for drilling different depths of holes is very simple and convenient. All bearings are of the oil well type. The levelling of drill points is also provided for by the vertical adjustment of the spindles. The elevation of the table is provided for, by means of a screw and hand wheel.

The automatic feed by worm and worm gear incorporates other features. The depth to which a hole can be drilled is increased from 1½ inches to 5 inches. In this machine also, the adjustment for the automatic release for any depth of feed is not only quite simple but rapidly accomplished. In this case the releasing device disengages a latch arm which allows the worm to fall out of mesh with the gear. When overload occurs, the safety device operates on this latch arm also. The worm gear is keyed to a shaft which is connected to the spindle by means of a rack and pinion. The capacity of this machine is somewhat less than that of the cam driven feed machine but its range of work is correspondingly increased.

**Wm. M. Preston**, who for the past six years has been general manager, secretary and director of the Canadian Tap & Die Co., Galt, Ont., resigned his position with that company on March 30th.

# Technical Education Applied to Railroad Operation*

By Professor H. O. Keay **

*A careful perusal of the contents of this paper will serve to show that a thorough grasp of the present day requirements of railroad transportation and operation has been taken by those entrusted with the training and equipment of those who will in the future be responsible for the development and progress of this important feature of Canada's agricultural, industrial and commercial life.*

NUMEROUS people continue to be disturbed by the question as to whether railway service offers what may be really called a profession. A brief consideration of the importance of the part played by the railways in our national life may help to throw some light upon this point. Recent figures indicate that over 30 per cent. of the entire population of the North American Continent have a direct interest in the railways through their private deposits of money at banks investing in railway property; men actually engaged in the service, together with their dependent families, comprise 10 per cent. of the population; and the production of railway supplies involves fully 70 per cent. of our industrial activities. Assuredly, if the administration and control of the intricate machinery of this vast enterprise be not a profession, it is a thing which so far transcends the ordinary profession that it demands the finest training which may be within our power to provide. The happy-go-lucky days of railroading, picturesque though they may have been, are passing. Scientific method is more and more necessary with the decreasing margins of profit realized in the affairs of transportation in general. With a public alert and keen to reduce the price of transportation of every sort, and an army of employees who are equally enterprising in advancing the cost of such service, the railways are finding that the candle has been burning at both ends for so long a time that it is, in many instances, becoming extremely difficult to hold. Under these conditions the official who has the broadest view of the situation, who can weigh the saving in one department against the disadvantage in another resulting from a given policy, is more and more in demand.

### Railway Educational Schemes.

It is felt in many quarters that the present process of promotion in some measure fails to give all that might be desired in breadth of training. The shell of departmental prejudice hardens with maturity, so the most favorable time to begin a broadening of view is early in the experience of the individual, when the mind is most receptive. A desire to furnish some means of providing a more adequate training of young men in the operating department is reflected in the various railway educational schemes which have been evolved on this continent and abroad.

The success or failure of any railway educational scheme rests largely, however, upon the manner in which it is woven into the practical fabric of the railway itself. If the student is left to wander at will into the maze of railway life and there attempts to square up his theory with what he finds, the results may fall short of our expectations. His practical training should be definite, and mingled as closely as vacation periods will permit with his university work. The university must be the place of method; the railway the place of practice; and each should complete itself in the other in a well balanced experience. To this end, arrangements have been made with the Canadian Pacific Railway whereby definite practical training is offered to a number of students in the Transportation and Mechanical Courses of the University who care to avail themselves of this privilege. Thus, the summer vacations and a period of two years after graduation may be utilized to give the student a broad practical railway experience, with a view to developing men for official positions.

### The Transportation Course.

The summer training for both Transportation and Mechanical students is the same for the first two years; at the end of which time, students are required to make a decision as to whether they desire to adopt the Transportation or Mechanical Course. The work arranged for Transportation students is as follows:—

First Year (Vacation).—Three months as special apprentice at the railway shops.

Second Year (Vacation). — Three months as special apprentice at a round house.

Third Year (Vacation). — Three months in road service as an extra brakeman.

*Abstract of paper read before the Canadian Railway Club, Montreal.

**Of McGill University, Montreal.

After Graduation.—Three months in station service, three months in Stores Department, three months in Master Mechanic's Office, six months on track work, three months in Accounting Department, six months with Train Master.

In connection with this Transportation Course, the Grand Trunk Railway has under consideration an even more comprehensive scheme of practical training, incorporating some of the additional advantages of that of the Great Central Railway of England.

### Railroad Official Opinions.

No educator is so blind as to be unaware of the fact that many a college man has failed to "make good" in railway work, and in the building up of this Transportation Course no pains have been spared to search out the common causes of failure, and so far as possible, to correct them. Perhaps the testimony of one or two eminently successful men will be of interest. In discussing this course recently a prominent Canadian railway official gave the following as his opinion:—

"The immediate trouble with the ordinary college graduate is that he has climbed to a higher plane of thought, from which he finds it difficult to descend again to the details of practical work. His breadth of view has unfolded visions undreamt of by the fellow submerged in the details, but the development of generalities and principles has given him a distaste for the necessary fundamental facts of a business from which he has been too far removed.

"Starting with three men of equal native ability—one in practical railway work, one in the ordinary college course, and the third in this Transportation Course, it is my opinion that the practical man will keep ahead of the man of ordinary college training, but that the one who has followed a course so balanced between the practical and the theoretical as the one described, will outdistance both of the others."

Mr. F. W. Taylor finds that lack of discipline in many of the colleges is responsible in part for some of the failures. He says: "During the four years that men are in college, they are under less discipline and are given greater liberty than they have ever had before or will ever have again." . . . . . and, further, "In facing this question, I would call attention to one class of young men who are almost universally imbued with an earnest, logical purpose; namely, those who, through necessity or otherwise, have come into close contact and direct competition with men working for a living. These young men acquire a truly earnest purpose. They see the reality of life, they have a strong foretaste of the struggle ahead of them, and they come to the university with a determination to get something practical from the college training which they can use later in their competition with men.

"I believe it is possible to so train young men that they will be useful to their employers almost from the day that they leave college, so that they will be reasonably satisfied with their new work instead of discontented; and to place them, upon graduating, one or two years nearer success than they now are. This can be accomplished by giving them an earnest purpose through six months' contact, early in their college life, with men working for a living; by rigidly prescribing a course of studies carefully and logically selected with some definite object in view; and by subjecting them to a discipline comparable with that adopted by the rest of the world."

### Combination Theoretical and Practical Training.

In endeavoring to overcome the usual objections to the college graduate, it is felt that a number of points of advantage have been brought out. The subjects included in this course have been brought close to railway needs and problems. The four month vacation periods have been utilized to alternate the theoretical and practical work in as perfect a balance as circumstances will permit, to the end that the student is never long out of contact with serious actual work and the advantages which come from early competition with the wage earner. Here a respect for order and discipline is impressed indelibly, and the truth brought home that to ever hope to command, one must first learn to obey. It is expected that the graduate will ultimately specialize in one department or another, but our faith is founded on a breadth of training before any intense specialization, and at a time when this can be accomplished without humiliation or apparent retrogression.

The course is young—its first graduating class being in 1908, and its graduates are not a numerous body, yet among those who have followed out the practical training with their theoretical work are already numbered two locomotive foremen and two train masters.

### The Ultimate Aim.

The ultimate aim of the Transportation Course is to produce sound men who can "think straight," who have learned the value of co-operation and team-work versus a selfish individual "record,"—who have the perspective to measure the saving in one department against the consequent loss in another,—in short, who represent not so much the genius as the well balanced man who can work steadily to the best advantage of the company and to himself. No less a product is due the railways of Canada, who have given to the University an enthusiastic encouragement and financial support so far unparalleled in the annals of industry.

## EVOLUTION IN THE MACHINE SHOP.

In the good old days of machine shop work considerable time was wasted in placing large pieces of work in the various machines, says an exchange. As the iron and steel work increased in size it was necessary to keep building larger machines to finish up the heavy castings. Now it has become the fashion to take the tool to the work rather than to carry the work to the tool.

In the turbine shop of the General Electric Company at Schenectady, N.Y., one can daily see a powerful electric crane carrying along a drilling machine, or some other machine, and placing it carefully inside the casting for a modern 30,000 horse power steam turbine. When the work is finished the machine is taken away and another substituted.

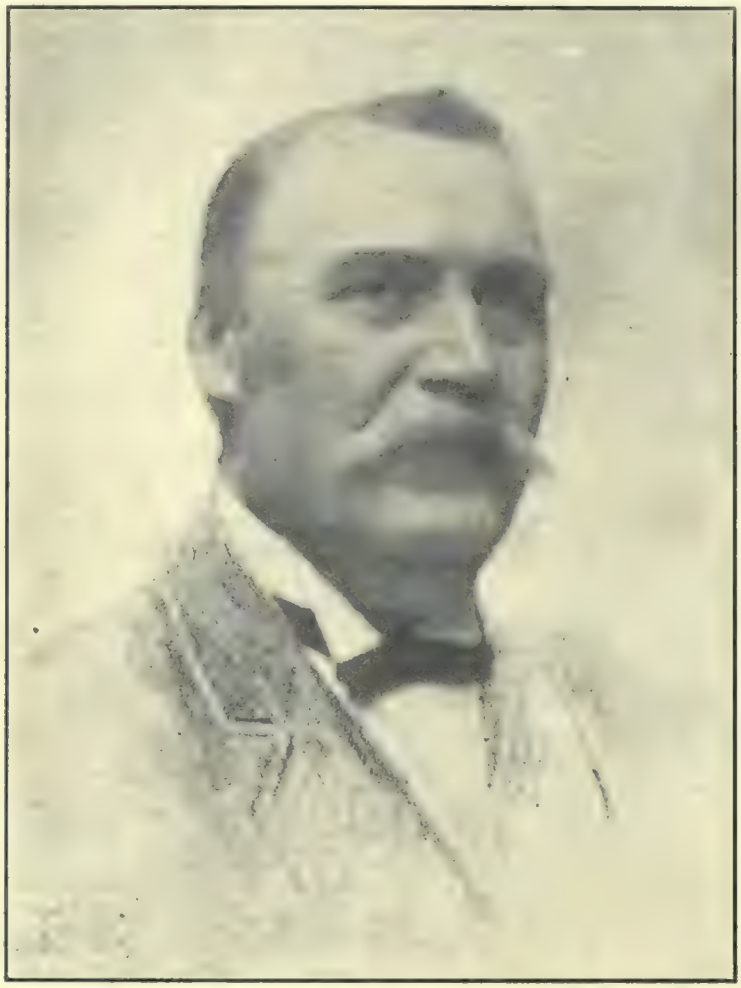
This change in machine shop practice is almost wholly due to the utilization of electricity and the flexibility of power which it permits. The machines are all driven by individual electric motors mounted securely on the frame and fed by a small armored cable which can be carried to any part of the shop. It is easier to lift and carry these small machines to the work than it would be to handle such mighty castings over and ever again.

## CHANGE OF NAME.

It is proposed to change the name of the American Brass Founders' Association to the American Institute of Metals, and members have been called upon by W. M. Corse, the secretary, to vote upon such a change in the constitution. This is believed to be advisable on account of the fact that the name will indicate a much broader field. The present name indicates that the work of the society is confined to brass exclusively, and it is desired to increase the scope to all non-ferrous metallurgy. This has been done in England by the Institute of Metals and it is expected that the American transformed society will be conducted more along the lines of the English Association. The next meeting will be held in Buffalo in September and this change has been made on account of lack of facilities for holding the annual convention earlier in the year.

## THE LATE MR. W. T. BROWN.

WE regret to have to record the death of Mr. W. T. Brown, one of Canada's prominent and successful sons in the realm of mechanical engineering; the unlooked-for event having taken place on February 9, at his home in Galt, Ont. On previous occasions due to periodical breaks in their ranks, we have been called upon to refer to the large part such men as the late John Dyer, Thomas Pringle, Walter Laurie, Edward Lamb and J. C. Weir have played in the development of mechanical engineering activities and successful undertakings, and to these must now be added the name of Mr. W. T. Brown, who for nearly a quarter of a century has been connected with the engineering department of the Goldie & McCulloch Co., Galt, Ont., during which long period he had won and retained the confidence and respect not only of his employers, but that of all with whom he came in contact in both a business and social capacity.



THE LATE W. T. BROWN, OF GOLDIE & McCULLOCH, LTD., GALT, ONT.

Mr. Brown was born in Toronto in the year 1846, but when quite young, moved with his parents to Bowmanville, where he served his apprenticeship with Meads & Son, founders and machinists. On completing same he returned to Toronto for a short time, after which he went to Oshawa, where he was a valued employe for a number of years of F. W. Glenn. It was in Oshawa that he met Miss Annie Davey, to whom he was married in 1867. They resided in Oshawa until 1874; leaving for Ottawa in that year when Mr. Brown became superintendent of the waterworks. In 1880 he moved to Cleveland, Ohio, where for two years he was superintendent in the machine shop of the Cleveland Rolling Mills. In 1882 he and a partner went into business in Carleton Place; which business was later moved to Dresden. In 1886 he disposed of his interest in the partnership and came to Hamilton where he was superintendent of the Beckett Engineering Co.'s works.

It was in the year 1889 that he accepted a position with the Goldie & McCulloch Co. of Galt, with which firm he remained until his death. During the first few years of his connection with the Goldie & McCulloch Co. he acted as traveling representative and superintendent of erection. He was later made their mechanical engineer, and for the last six years has acted as their estimating engineer. He left his desk on the eve of February 9, in his usual health, and in less than an hour had gone to his reward; his very sudden death being due to heart failure.

Mr. Brown was a true friend, a man of sterling integrity and greatly beloved by all who knew him.

## PORT NELSON AS HUDSON BAY RAILWAY TERMINAL.

THAT Port Nelson shall be the terminus of the Hudson Bay Railway in preference to Fort Churchill is decided by the report of Chief Engineer J. Armstrong, in charge of the construction of the road, and of the surveys which have been in progress during the last two years to determine routes. This report, dated January 23rd last, was tabled in the Canadian House of Commons on March 4th by the Minister of Railways and Canals. In brief, Mr. Armstrong finds that while Fort Churchill has naturally the better harbor protection, it has an inadequate site available for railway termini; is open for only five months in the year, and involves a longer and more expensive route, with greater cost of annual maintenance. Port Nelson, on the other hand, has ample and easily utilized terminal sites, is open seven months in the year for navigation, and from the standpoint of ultimate utility is decidedly to be recommended. A comparison of routes shows that the distance from the Pas to Port Nelson is 418 miles, as compared with 498 to Churchill. The Port Nelson route has a gradient of only 4-10 of 1 per cent., and on an estimate of 3,000 trains per year could be operated, including all interest charges, for about 3,000,000 dols., or about half a million less than the Fort Churchill route.

As to the question of terminal sites at Port Nelson, it is interesting to note in view of the recent Order in Council giving Ontario the south side of the harbor mouth, that Mr. Armstrong declares suitable terminal sites are available on either side of the river. The cost of terminal development at Port Nelson, having in view the handling of from 60 to 70 million bushels of grain within sixty days, is estimated at 20,000,000 dols.

A comparison is given between the proposed route from Saskatoon to Port Nelson, across to Hanna Bay, and thence via the Quebec and Lake St. John Railway to Quebec, and the present route from Saskatoon to Fort William and Montreal via Parry Sound. The total length of the former route is 1,950 miles, of which 750 miles is water carriage; the total length of the latter is 1,950 miles, of which 680 miles is water carriage.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. VIII. APRIL, 1912 No. 4


## METHODS AND DEVICES.

IT is hardly necessary, perhaps, for us to draw attention to the department of "Machine Shop Methods and Devices" in the present issue of Canadian Machinery, illustrating as it does in a marked and effective degree without egotism or "still life" portraiture "who's who?" "what's the reason and why," in matters pertaining to the progress and development of mechanical engineering and machine manufacturing practice.

The community of effort reflected in those pages is, needless to say, a source of more than passing pleasure to us, believing as we do that most men are "from Missouri" and want to know, not only what Jimmy Jones is accomplishing, but the manner and method adopted and employed. Vague generalities, which tell of wonderful results achieved, yet carefully avoid detailing the conditions and circumstances, are much like asking a hungry man to help himself to a meal by lapping the steam from a restaurant window. If we or you have something worth telling to others, let us do so to the fullest extent necessary and possible; realizing that fairy tales and smoking room stories belong to a class of literature somewhat distinct and remote from that devoted to mechanical engineering.

Our range of contributors in this issue includes all the provinces of the Dominion and some from England.

## DOCTRINES OF SUCCESS.

IF we would judge by the prominence given to the achievements of individuals in the accumulation of material wealth and be guided into the belief that therein lies the true and only solution and attainment of success, then without much stretch of imagination or superiority of perception, it is a safe and reasonable conclusion to affirm that the already well packed battalions of desperados will continue to add recruits to their ranks. Fortunately for the individual, the business world, the community and the country, there exists a wealth of balanced brain able to discriminate between the real and mythical. Men of this latter stamp—we all know them, and you are without doubt one of the number—have and are attaining success daily, by achievement just as great and possibly more so than the majority of those so prominently idolised.

You hear and read of jobs which will command salaries of $50,000, $25,000, $10,000, $5,000, etc., per annum being impossible of filling, as the men to hold them down are not available. You scratch you head, do a little hard thinking; yes, even philosophize and arrive at the conclusion that no power or institution on earth will qualify a man to fill either one of them unless he be offered it and have an opportunity to make good. We are told that the ranks of mediocre men are bulging to the bursting, while those of the gifted and talented are yawning and gaping to be filled, yet it never seems to occur to the instigators of these wild and extravagant utterances that they are alone to blame for existing conditions. They lose sight of the fact that a large proportion of what are dubbed "mediocre" men, have attained the highest success in their sphere, and that only by systematically applied prejudice on the part of those higher up are they forbidden opportunity to rise.

With all the necessary deference to those who presume to speak of success as so many thousand dollars per annum of salary, or millions to their name in a bank book, let us say that the bulging of the "mediocre" ranks is largely due to real heroic success achieved and that the gaps in the other are more or less due to a distorted view of conditions, ignorantly or purposely chosen. Most men, yes, even "mediocre" men, possess the bump of common sense to a large degree, therefore, their conception of tall stories of salaries available is likely to be more or less uncomplimentary to the originators of the latter. There will always be those who have won success as measured by dollars; a few who have achieved the distinction of real success and dollar wealth in addition; but it may not be forgotten that the great majority must be content with real, naked and unadulterated obscure achievement.

How idle, even criminal, is it then to dangle impossible and meaningless doctrines around which, it is known full well, cannot be compassed The business man or manufacturer we are so prone to laud has been a success because of the accumulation of the combined successes of those who served him, and not to the extent some would have us believe, because of his own foresight and acumen. His success has been achieved by loyalty of the rank and file and just in proportion to his material recompense and theirs may his loyalty to them and real success be measured.

## U. S. MACHINE TOOLS AND TARIFF REMOVAL.

NOT the least important projected legislation of recent times has been the proposal to remove the tariff on machine tools entering the United States. Naturally the home builders of these commodities resented being called upon to meet competition on a free import basis, and took steps to combat the measure and prevent it becoming law. British-made tools, even against a high tariff, find a market to some extent in the United States, and it would be a natural result, due to lower labor cost, and a free market, that a largely increased trade would materialize. Our view is that the possibility of a tariff removal on machine tools entering the United States is a remote contingency.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

### ONE WAY OUT.

By Donald A. Hampson.

ABOUT noon, Walsh, the well driller, phoned that he was sending in a stem to be re-threaded and asked if he could have it done right off. I told him it would be started as soon as it arrived and thought no more of the job until it came in, for we often re-cut his worn and bruised threads. When that stem showed up, however, it was 9 feet long. Previously pieces of from 4 to 6 feet had been received, and even these were about 18 inches longer than we could take between center. It might, therefore, almost as well have been 18 feet too long; but having agreed to do the job, I could not back out. As I already had a mental conception of the expedient to be adopted, Walsh was called up, the situation explained, and his O.K. secured regarding the extra cost.

There were in the shop two lathes of 20 inches swing x 4 feet between centers and alike in all respects. They had passed their first youth and were used for rough work, so we didn't object to tearing them down for odd jobs. After removing the headstock of one and the tailstock of the other, the lathe A. (see drawing) was moved up against lathe B. Long parallels, one shown as P., were set on the ways on each side and held with heavy C-clamps. Below straps and a pair of long bolts between the legs tied the lathes together. Wedges were slipped under the feet of A. to level up. I put the carriage of A. in gear with the head of B. and had a coupling, C., made to join the lead screws.

In order to get the right taper, the lower part of the tailstock was entirely removed and the upper part mounted on parallels laid across the lathe, in which position it was clamped by a pair of 3-4 inch hook bolts, D., passing over the extended ends and secured below by straps across the bottom of the lathe bed. Owing to the limit of carriage travel, due to the parallels under tailstock and also to the big "set over" in getting the taper from 2 inches to 3 inches on the short length of thread, the regular tool post could not be used and an extension slide rest, R., was bolted to a wing of the carriage and held the thread tools. E. is a length of 2 x 4 inches to take the end thrust off the centers.

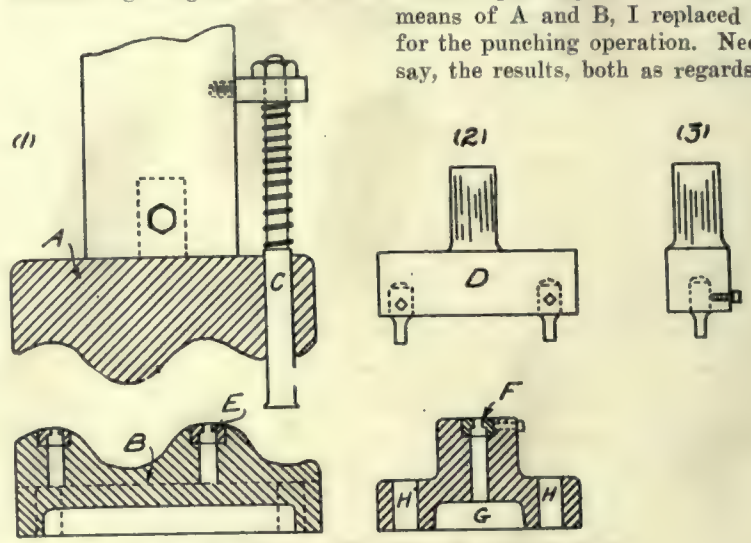
Though several men were employed all the afternoon getting this combination ready, the customer got off much easier than if the job had been sent to a distant shop; which proceeding would have involved transportation charges, his own men's time, and incidental delays. Fortunately for us, we had lots of help available and an unusually complete shop equipment to draw from.

### JIG FOR PRESSING AND PUNCHING CORRUGATED SHEETS.

By G. Barrett.

THERE is here described and illustrated a useful jig for pressing and punching corrugated sheets. As I had a large number of these to do, the jig A was made to press on the fixed block B. The rod C keeps the sheets until the press meets them, the spring giving the necessary tension. I used the block B also for punching by making extra steel dies and the punch D. The lower figure, No. 2, shows the side view of block B, which, it will be noted, is cored out at G to catch the punchings. Four holes H are for fastening down block B.

After pressing the bent sheets by means of A and B, I replaced A by D for the punching operation. Needless to say, the results, both as regards quality and quantity of performance, amply justified the outlay for jig equipment.

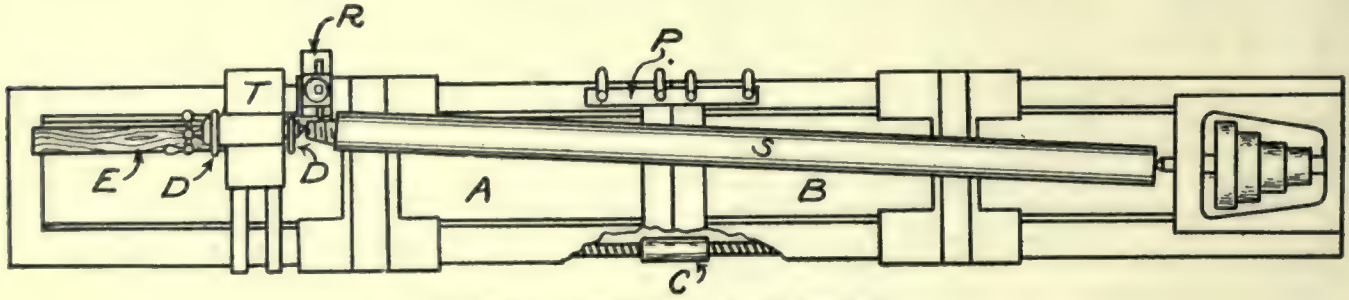



Jig for Pressing and Punching Corrugated Sheets.

### FITTING TAPER BOLTS.

By T.R.

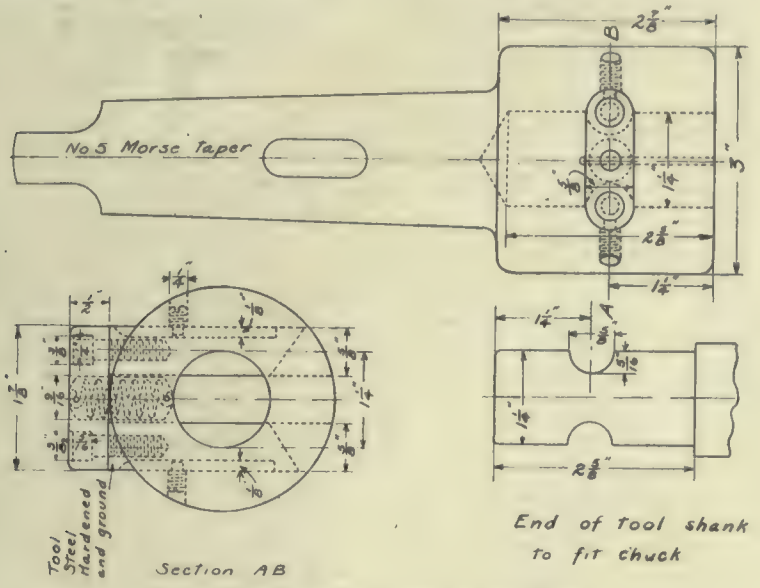
IT is an everyday job in a locomotive shop for machinists to make bolts for big ends, frames, etc., which have been previously broached-out; but it may happen that, while knowing the amount of taper:—1-16-inch per foot, the top and bottom edges are burred or chipped, thereby making it a matter of more or less chance if you strike the sizes accurately with calipers at the first trial. An




One Way Out—Re-threading a Well Drill Stem.

easy way out of the difficulty is as follows:—

Turn a long taper pin and polish it smooth; making the large end something in excess of the size of bolt you are called upon to provide, and the small end, something smaller than the bottom hole. To find the different sizes — chalk the whole length of your taper pin on opposite sides and insert into the hole. By first revolving the pin at the top and then at the bottom, you will get the desired sizes from the rubbings. If you now make allowances for driving the bolt home, much time and worry will have been saved, especially if you had to go far to test the taper and fit.




Special Chuck for Jig Work in Drill Press.

## SPECIAL CHUCK.

THIS special chuck is used for jig work in a drill press, where a large variety and number of tools are required on the particular job in hand. The chuck will push down, pull up and turn anything within its range without fear of the tool dropping out; the latter contingency being impossible until the tool is released by the operator. This, however, he can do instantly, without the use of a wrench or other appliance.

The body, of machinery steel, is case-hardened on the tang to prevent battering. The tool shanks have two half-round slots milled across them, and two sliding grips in the chuck fit into these. The two sliding grips are connected by a bar of steel, so that both can be pulled out together. These are held in place by a spiral spring, with a dog pointed screw fitting into it. A key way is put into each grip so that it can only be pulled out far enough to release the tool; there is, therefore, no chance of stretching the spring beyond its limit of elasticity. The sliding grips are of tool steel, hardened, ground and closely fitted to the holes.

This chuck has driven a 3-inch 12 T. tap in cast iron, only one tap being used in the hole, and no marks were visible on the tap shank.

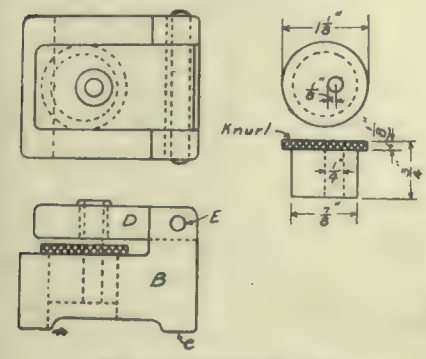



Fig. 1—Simple Drill Jig.

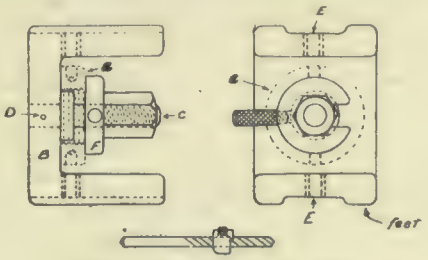



Fig. 3—Simple Drill Jig.

## THREE SIMPLE DRILL JIGS.

By Chas. Hattenberger.

IT is agreed among foremen and toolmakers that a jig must be durably constructed, fool proof, and simple to operate, as the user is generally an unskilled man or boy. These features are all embodied in the jigs shown in Figs. 1, 2 and 3.

Fig. 1.—This jig was made for drilling the fitting seen on the right, which is a cam used for adjusting the spark on a gas engine. The pieces were first turned up in the lathe and cut off to the proper length. The ¼-inch hole had to be ⅛-inch off centre, and was drilled in the jig as shown. "B" is the body, with a ⅞-inch hole bored at right angles to the feet, "C." "D" is a hinged plate, which carries a hardened steel drill bushing. This bushing is located ⅛-inch beyond the centre of the hole in "B." The hinged plate is a working fit in a slot cut in "B" and swings on the tool steel pin "E" which is hardened and ground. The pin should fit tight in "B" and be a working fit in "D." To operate, insert the fitting and bring down the hinge "D." No screws or clamps are needed for fastening, as the hole drilled being off centre will not permit the cam to turn. The parts "D" and "B" are of soft steel. A cam is shown in the jig.

Fig. 2.—The bronze bushing shown requires to have a 9-64-inch hole drilled in it. To accomplish this rapidly and ensure interchangeability, the jig shown was made. The body part "A" was made of soft steel, and a portion of the base was milled away to form the feet "C." The drill bushing was placed in a plate "B" which was fastened to "A" by three ¼-inch fillister head screws. The bronze bushing was inserted in the opening "D," then placed against the stop pin "E," and fastened by the clamp "F," which is operated by the screw shown. A spring was placed under the clamp to hold it up when the screw was loosened.

Fig. 3.—This jig is used for drilling two 3-16-inch spanner holes in the 15-16-inch 14-thread collar shown by the dotted lines at "A." It consists of a channel shaped frame or body "B," each end having a portion cut away to form the feet. The centre bolt "C" is held in place by a ⅛-inch pin "D," which extends through the bolt. Two drill bushings "E" are pressed into the frame "B" and the washer "F" has a slot cut in one side which allows it to be rapidly removed without first undoing the nut. The size of the nut across the corners must be slightly smaller than the size of the hole through the collar at the root of the thread. A knurled handle is

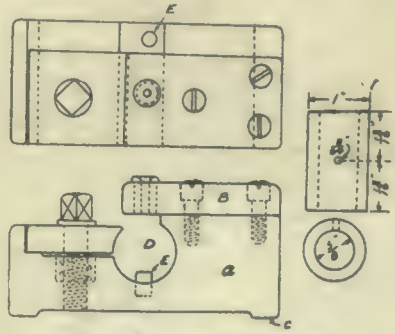



Fig. 2—Simple Drill Jig.

provided to remove the washer. To use the jig, slip the collar over the nut to the flange of the centre bolt. The diameter of this flange is .815 inches. The washer is next put in place and fastened by the nut. First drill one hole, then turn over and drill the other. The centre bolt and nut are pack hardened, and to insure the holes being of the same depth, use a drill with a stop collar as shown.

## RADIAL PLANER TOOL CRITICISM.

By A. P.

THE reason for this letter is not that I wish to cast any reflection upon the writer of the article, "A Radial Planer Tool," which appeared in your February issue; rather is it to point out where the construction is incorrect, its weakness and undesirability for service. Being located several thousand miles away, I have not, of course, seen the apparatus in operation, at the same time, I venture to say that the tool did not and will not take even a decent cut without chattering or digging into the work. Further, to do planing of any kind with a tool holder such as it, only very light cuts can be taken, which in these days of high speed tool steels and keen competition cannot well be tolerated.

Figure 1 is a side elevation of tool and holder referred to, with the addition of part of the clapper box, for the purpose of facilitating the explanation of the defects, etc. It is well known that a tool under the action of cutting tends and actually does spring away from its work at about its point of support. Upon examination of Fig. 1 we see that the point of support is at A. Designating the cutting edge of tool as B, let us take A as centre and A B as radius and describe arc C D. By noting its direction, it is at once obvious that the tool moves in the path C D in the direction indicated, thereby doing its utmost to dig into the metal.

Fig. 2 is practically the same as Fig. 1, except that the revolving tool holder which carries the cutting tool is placed behind the shank instead of forward of it. Using the previous reasoning, we find by taking point A as centre, A B as radius and describing an arc C D, that the cutting tool not only tends to, but actually does clear itself, due to its spring under the weight of the cut. Further, when the shank springs back in this manner, it attains an additional elastic force or resilience which is most useful in overcoming such places on the casting as may be harder than others, not to mention the fact that the job when finished has a superior and workmanlike appearance. There is also the time saved in being able to get at it without fear.

After the foregoing explanation, I don't think it necessary for me to point out that the tool carried as shown in Fig. 2 and will stand up to its work for a longer period and at the same time be capable of taking heavier cuts.

## LOCOMOTIVE SIDE RODS. FITTING KNUCKLE BUSHES AND BRASSES.

By T.R.

FITTING knuckle bushes and side rod brasses into new rods is a cinch, but when they have to be renewed on a locomotive that has seen its best days and there are no facilities, after the bush has been pressed home, to bore it out to size so that it makes an easy fit on the pin for running purposes, the operator is kept guessing.

You will find, after removing the old bushing, that the holes are "out of round," due to pounding; being as much as 1-32-inch in knuckle bushes and slightly more in side rod brasses, lengthways. As your lathe is not made to turn pins to suit distorted holes, you must take your size diagonally, leaving the calipers a shade tighter for a driving fit; then, by allowing a bare 1-32-inch for knuckle bushes and a full 1-32-inch for rod brasses over the pin sizes, you will have little trouble in securing a good fit, provided, of course, that your pins are o.k.

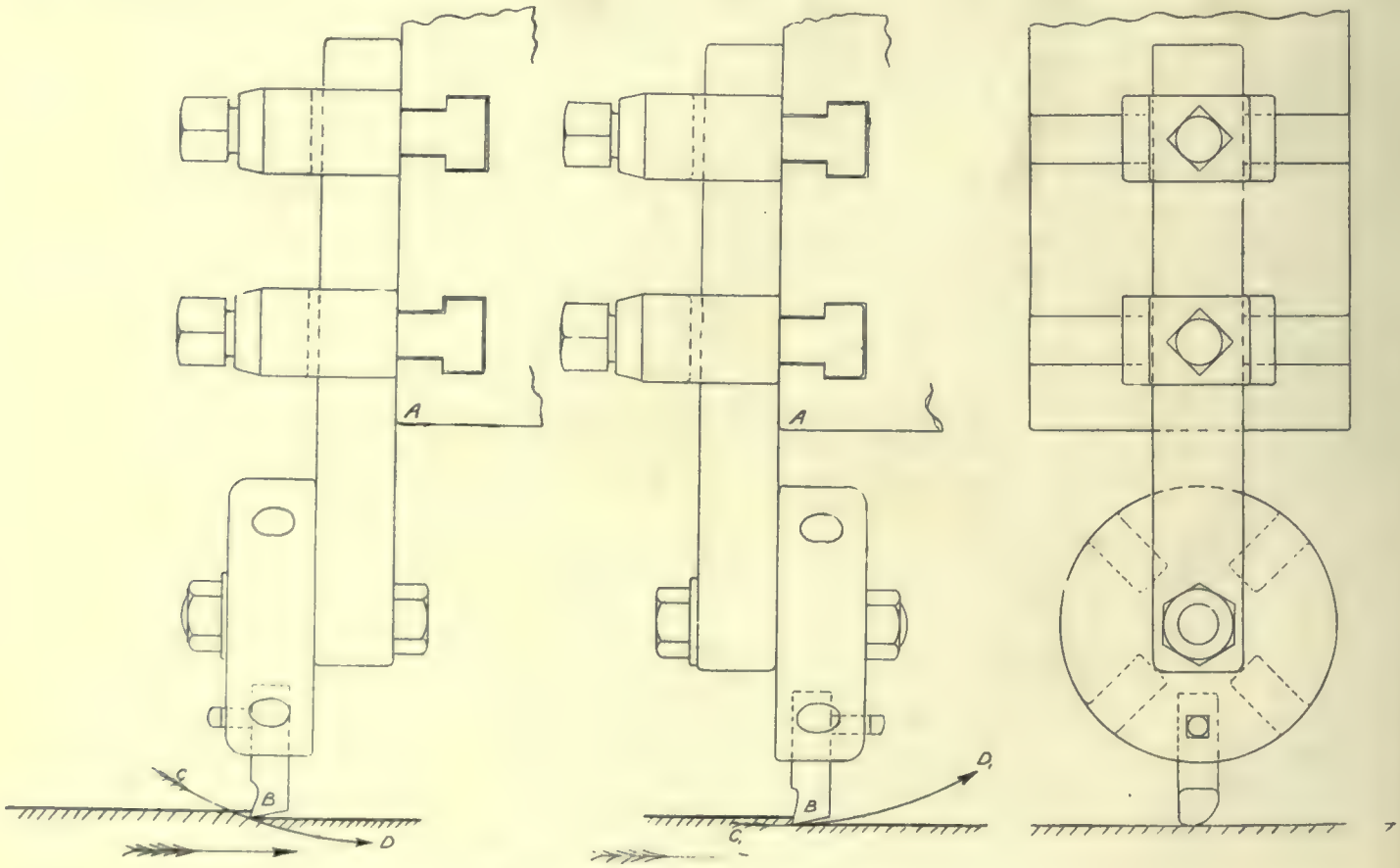


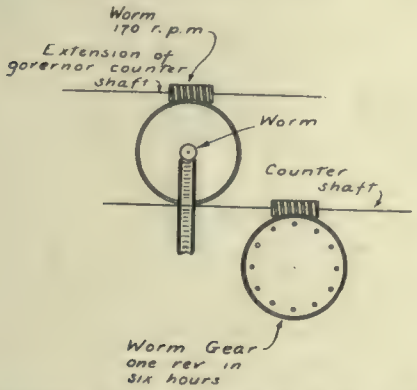

Fig. 1.—Radial Planer Tool Criticism.—Fig. 2

## AUTOMATIC OPERATION OF HYDRO-ELECTRIC PLANT.

By W. A. P.

A RATHER ingenious device was constructed by the attendant employed to operate a miniature hydro-electric plant which supplied current to the buildings and grounds of a small summer institution.

A worm, which operated a train of worm gears and worms, was keyed on an extension of the shaft carrying the small governor pulley. The speed was reduced in this train from 170 r.p.m., the speed at which the first worm ran, to the remarkably slow speed of one revolution in six hours. The last gear in the train was this slow revolving link. About three-quarters of an inch from the outside of the rim of this gear, a series of twelve small holes was drilled, and a pin made which, when inserted in any




Automatic Operation of Hydro-electric Plant.

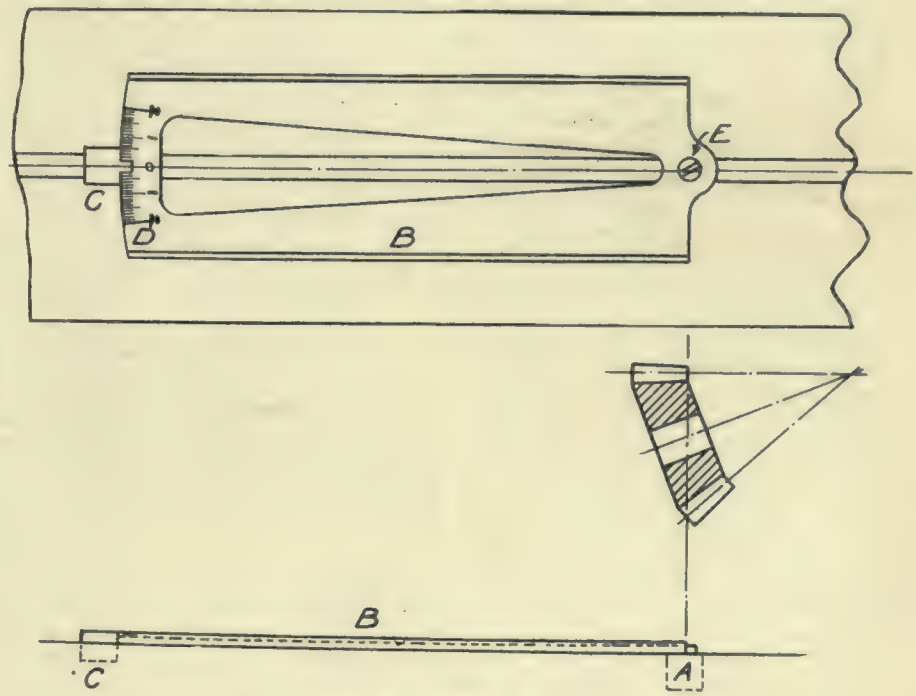
one of these holes, would at a given point in its revolution release a dog. This dog caused a small shelf to collapse and a weight resting on the shelf, had in consequence to be supported by a cotton rope tied to it and connected with a lever through a small pulley.

The sudden force thus imparted to the lever engaged a clutch which slid along a revolving shaft on a feather key, and this in turn set in motion the gate closing mechanism. The gate when closed was prevented from further motion by a positive stop. The timing was extremely simple. There were twelve holes in the rim. One revolution occupied six hours, therefore, if the dog were released at a given moment, and the pin immediately inserted in the next hole it would be exactly one half hour before the dog were again released. The plant could, therefore, be automatically closed down at the end of any half hour period, up to six hours.

## CUTTING BEVEL GEARS.

By J. A. Wright.

THE following description of an attachment for cutting bevel gears may prove of interest to some of my fellow readers who have similar jobs perform. Referring to the cut, A is a block made to fit the slot in the miller table, and having that portion, which projects above the table, turned circular. B is a plate made to fit the head of the miller, allowing the latter to slide into any desired position. C is another block made to fit the table slot, having its upper face scribed with a centre line. D is a graduated arc on the back end of B, and E a hole reamed to fit the turned portion of A. The line F indicates the front end of the teeth to be cut. The universal head is set on the plate B, so that the line F coincides with the centre of E; the centre of the cut at F will then revolve as on a dead centre, requiring




Attachment for Cutting Bevel Gears.

no side adjustment of the table, if the cutter is of correct size.

Suppose the distance from the centre of E to edge of scale D is 20 inches and that we have to cut a tooth 2 inches long, from each side of which .06 inch has to be removed. To do this, the table B will be swung over about the centre E, until the scale D reads .6 inch, right and left alternately for the two cuts. Rule: Divide the distance in inches from E to D by the length of the tooth in inches, then multiply the amount to be removed from each side of tooth by the quotient thus obtained. The product is the amount the table must be swung over each way at D. The scale is graduated (full size) in inches and tenths of an inch.

After the two cuts have been made, the operator can considerably reduce the amount of subsequent filing necessary by running in sufficiently far a cutter of correct pitch for the small end of tooth, to show the true shape and form a guide for finishing.

## EVERY DAY EXPERIENCES.

By H. A. W. Picton.

A MACHINIST'S duties are as a general rule more or less varied, especially when employed in smaller shops whose product is not standardized to the same degree as that of the larger shops. This varied nature of the work presents a great opportunity for men to pick up kinks and develop original ideas. A great many of these bits of knowledge, stolen as it were from the books of experience, may prove very interesting to our readers who pursue similar vocations.

### Tool Grinding.

In a shop where there were several lathes with long beds, on which shafting was often turned, there happened to be one of these machines which was rapidly nearing the state where its usefulness was at an end. A "new" hand had been taken on and he was, of course, put on the old shaky machine. The "new" hand, however, was a man of experience and was not a little proud of some of the records he had established in other shops, for rapidly and accurately doing work. He realized the disadvantage under which he was laboring and this made him all the more keen to show his mettle. His past successes he could always trace back to one cause—namely, he was an expert in the art of grinding tools. He, therefore, carefully ground his tool, shifted the belt up one more speed, got started, and without the least appearance of chattering, the tool

continued to cut out the little curly pieces of steel.

The "new" operator held his own with the others, and the foreman, knowing the condition of the old lathe, was greatly surprised and decided to keep an eye open for developments. Pieces that usually caused a great deal of annoyance because they always persisted in chattering, were machined satisfactorily, and if on occasion a casting commenced to chatter, the speed was instantly reduced, the two spindle bearings tightened and the feed made less coarse. Then when the difficult surface was finished it was left without trace of chatter marks.

There is really always a reason for chattering, our friend says, and the commoner causes are the following:—

### Causes of Chattering.

The spindle upon which the cone pulley is mounted may be loose in its bearings, the cutting speed may be excessive, the tail stock may have moved, due to a larger end thrust than usual, or if the saddle was allowed to bump into it, thus loosening of the mandrel between centres. Again the tool may have too course a feed or it may not be properly ground. The cutting point of a round-nose tool should not be too blunt and thus have too wide a cutting edge; also the clearance must be sufficient. When these are correct it is quite appreciable because the metal peels off in symmetrical curls, quickly and quietly. If tool holders are used it is not good practice to fasten the tool in too closely. Always leave the tool out far enough to allow the chip of metal to curl undisturbed. It is also bad practice to allow the tool to be fastened out too far. The overhang of the holder, also, should be reduced to a minimum, as this may sometimes cause chattering. Thus it is seen nearly all the causes of chattering arise from sources which are easily removed by a wide-awake machinist, except when caused by a badly ground tool. However, sometimes work will chatter in one place only, due generally to the method of driving. A dog fastened to a mandrel by means of a set screw sometimes causes chattering. It is often removed by placing a piece of cotton waste in the slot in the face plate of the lathe, in which the crooked tail of the dog is placed.

When facing a hub of a gear or pulley and you wish to lock the saddle of the lathe, it is usually accomplished by locking the nut in the lead screw of the lathe. Now, if the lathe is used a great deal, there is bound to be a little lost motion or back-lash here and to overcome this, it is always wise to throw in the nut when the tool is a short distance from the work and pull it up to the work by giving the gear on the end of the lead screw a turn or so by the hand. Then, when the tool is fed into the metal by the cross feed, it will face the hub squarely, which would not be the case if there were any lost motion to be taken up. Another little factor comes up for consideration here. With a round nose tool, a fillet will be left around the circumference of the bore. This is usually removed with a diamond pointed tool. Great care should be taken to avoid scoring the mandrel, as this is extremely bad practice. Some shops, however, have all their standard sizes case-hardened, and injury to the point of the tool will result before the mandrel is marked.

### AN APPRECIATION.

**Pleased find enclosed three articles for your "Machine Shop Methods and Devices" department; if those are suitable you may have more. I can assure you that this section of your paper is doing a great work among the boys by fostering discussion and teaching them how to plan and perform their work intelligently; therefore, economically and expeditionsly; concerning which, otherwise, they would be ignorant. Wishing your journal every success — R. T. J. R., Sutherland, Sask.**

Speaking of cross feeding calls to mind a means by which a compound rest on a large lathe was operated by power. On the end of the spindle, outside the bearing that was remote from the face plate, an eccentric whose eccentricity could be varied, was placed. To this was attached a long rod; the other end being attached to an arm fastened to a small shaft on the wall behind the lathe. As the lathe revolved, the eccentric, through the rod and arm on the shaft, caused this shaft to oscillate. Several other arms were fastened to this shaft by set screws, at various intervals along its length. To any one of these arms a small chain was attached by means of a hook, and several holes drilled in that end of the arm distant from the shaft. The other end of the chain was fastened to a handle which operated a ratchet on the end of the feed screw. In this way the tool was fed into the work. The usefulness of this apparatus was, that it would operate the rest at any desired angle, and was quite easily adjusted. In fact, there were three different places at which the amount of the feed could be regulated. Firstly, adjustment was at the eccentric. It's eccentricity could be varied, and, thus, the shaft could be made to oscillate through a greater or less portion of a revolution. Secondly, the little hook could be inserted in any one of several holes in the arm projecting from the shaft, and where the chain was fastened to the ratchet handle, there was formed the third adjustment. The ring on the end of the chain was slipped into a hook which was in a collar that could be moved close to the ratchet or as far distant from it as the length of the handle would permit.

This simple arrangement costs but a mere pittance and can be fitted to almost any lathe, yet the results accomplished are quite as uniform as if the feed screw had a constant motion instead of an intermittent one.

Every machinist has his own experiences and has made his own little discoveries; it is to be hoped, therefore, that the foregoing few observations may lead a number of Canadian Machinery readers to tell others of them.

## FORMULA FOR TURNING TAPER WORK.

By T.R.

MUCH time is wasted in a machine shop, which might otherwise be saved, because of the lack of a little elementary knowledge on the part of many first-class operators. For instance, the turning or boring of a long taper.

Assuming the former, with a length of 6 inches and a reduction from 12 to 7 inches. Let D equal the large diameter, d, equal the small diameter, and L equal the length. Then $\frac{D-d}{2\times L} = \frac{12-7}{2\times 6} = \frac{5}{12}$, which, if you have a machinist's book of tables and turn to those for tangents, you will find that 5-12 or .416, works out practically to 22½ degrees.

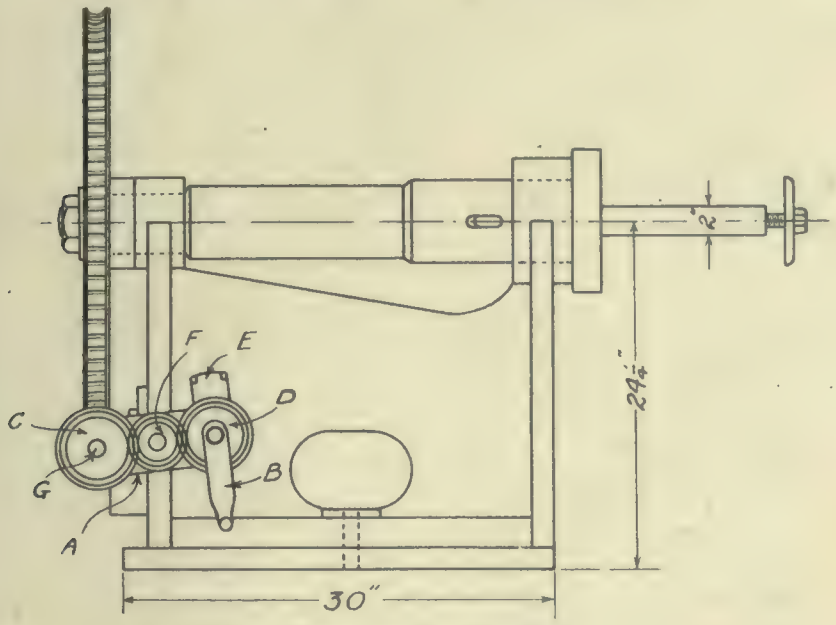
## GEAR CUTTING ON A PLANER.

By Wilson Herbert.

IN our small machine shop it was quite a common practice to cut spur gears from machined blanks on a planer. This operation was accomplished with the assistance of a "dividing head," a sketch of which accompanies this article. The shaft, upon one end of which is mounted the worm wheel, is supported by two cast iron bearings in the frame. The mandrel in the other end has a tapered shank which fits into the shaft; and is securely held there by a drift. Thus, the mandrel is easily removed and different sizes made available.

The blank gear to be cut is placed on the mandrel and held against the solid shaft collar by means of a cap screw which screws into the end of the man-

drel and holds a washer against the hub of the gear blank. The worm gear is of cast iron, 180 teeth and ½ inch pitch; the worm being 2½ inches diam. by 3 inches long, and dipping into an oil well, as shown. This worm is keyed on a shaft which extends through brackets on




Cutting Gears on a Planer.

either side of the frame. Both ends of this shaft, are threaded for a three-quarter inch nut.

The remainder of the projecting portion is finished to 1 inch diam. and a small ¼ inch keyway cut in it. Upon this is mounted a small spur gear C. Another small gear D, is attached to the bracket A, and to the pin upon which it is mounted, a small hand crank B, is connected. These two gears are meshed, and the nuts tightened in the bracket. Every time the crank is vertical it will slip into a small pocket E, unless prevented from so doing by the operator. Under some conditions, it is found advantageous to insert a small idler F, between these two spur gears. This, however, interferes in no way with the operation of the machine, only serving to reverse the motion of the worm, and as our prime mover is the hand crank, it is simply a matter of reversing its motion.

Suppose it is desired to cut 29 teeth in a spur gear blank. Let us put the little spur gear having 29 teeth, upon the end of the worm shaft G, and on the pin to which the hand crank B is attached, let us place a 60-tooth spur gear which will mesh either directly or through an idler with the 29-tooth gear. Now, one revolution of the worm gear is accomplished by 180 revolution of the worm. This causes the 29-tooth spur gear to make 180 revolutions to bring (180×29) teeth into mesh with the 60-tooth gear. The number of revolutions the 60-tooth gear would make is (180×29)÷60, which is (3×29). Thus, it is easily seen that 3 revolutions of the hand crank (3 revolutions of the 60-tooth gear) cause the worm gear to make 1-29 of a revolution, therefore the mandrel makes 1-29 of a revolution.

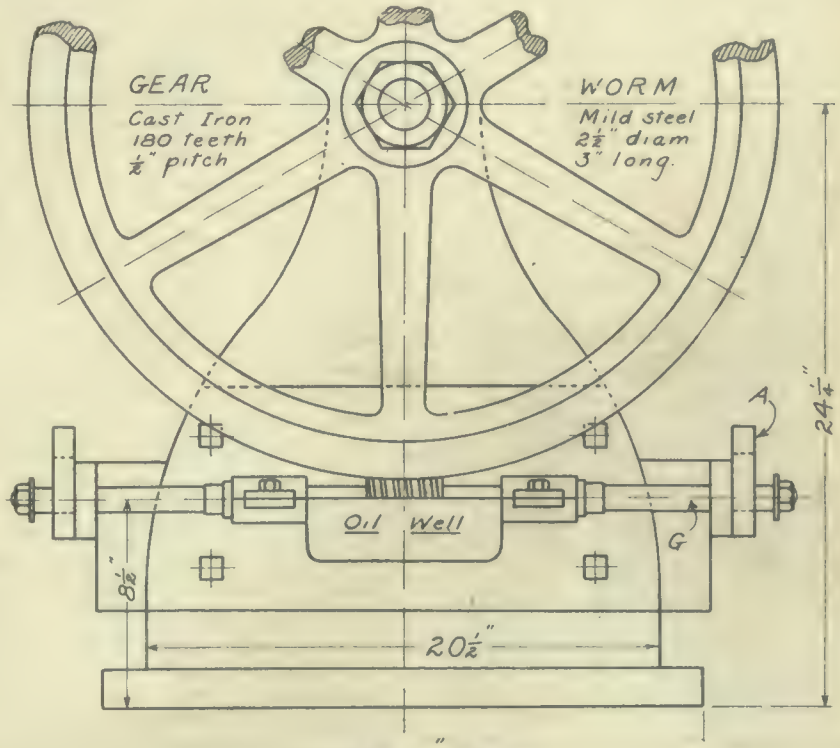
**Operating Process, Spur Gears.**

To cut a spur gear blank the dividing head must be clamped to the planer table with the axis of the shaft parallel to the direction of motion of the table. The gear blank to be cut must be placed on the mandrel and the set screw securely tightened. We have, of course, assumed that the bore of the gear blank corresponds to the size of the mandrel in the dividing head. If it does not, why a proper mandrel must be inserted or if a mandrel the required size is not available, it is an easy matter to make a couple of collars to fit over a smaller mandrel.

The first slot is usually cut with a square-nose tool whose corners are ground off to allow for a fillet at the bottom of the teeth. The width of this tool is of course governed by the pitch of tooth to be cut and can be determined from a little zinc templet which has three full size accurately shaped teeth filed in it. The limit of the space between the bottom of the teeth should not be slotted the first time because it is necessary that the finishing tool have a cut right to the bottom of the tooth. It is usual to feed in this tool horizontally.

Care must be exercised just here. Firstly, particular notice must be given to the clearance of the tool. Secondly, the little block in which are the four studs which hold the tool, should be in a horizontal position and the little pin on which it "locks" should be vertical. If these precautions be not attended to, and the tool should seize in a partially completed slot on the return stroke of the planer, the tool will tend to turn the gear blank slightly, with the result, that, when the tool enters the metal on the next cutting stroke it will cut the slot wider and, therefore cause trouble.

It is also good practice to have the tool long enough to extend through the block and to have a small spiral spring placed behind it to keep the block in its




Cutting Gears on a Planer.

position, because gravity does not avail, as it would if the block were vertical and rocked on a horizontal pin. When the blank has the required number of slots planed, one of the finishing tools is inserted, the cutting edge of this being ground to correspond to the curve on the zinc templet. If the circular pitch is large, it is perhaps wise to shape the tooth down to the pitch line only. When the foregoing operations are completed, the little index gears, hand crank and tool are removed to the other side of the dividing head, and the other side of the tooth face finished. The tooth is now finished down to the pitch line. The bottom half or flanks of the teeth are finished in the same way, the tools being ground so that their cutting edges correspond to the curve on the templet.

**Operating Process Bevel Gears.**

This method has also been employed to cut bevel gears when it was necessary to get them out with the greatest possible despatch. The gear blanks are machined as usual, but on the blanks two circles are scratched at each end of the teeth. These circles represent the whole depth and pitch circles for the large and small ends of the teeth. Here, we place the gear on the mandrel, small end towards the dividing head, and place the latter on the planer table so that when the planer has cut the slot the whole depth, it will be down to the whole depth circles at both ends of the teeth.

There are several ways of easily placing the dividing head at the proper angle. Two commonly practiced are:—First, set the head at approximately the angle, very close to the planer crosshead. Place one arm of a carpenter's square along the planed ways of the cross head and the other arm along the face of the gear blanks, so as to touch only at the extreme diameter of the latter. With inside calipers measure the distance to the whole depth circle at large end. Change the angle of the dividing head until the distance to the whole depth circle at the small end is exactly the same; then the head is set.

The other method is somewhat easier although it requires great care to set the head accurately. From the blue print of the gear to be cut, get the angle on a bevel by placing one arm of the bevel parallel with the axis of the bore of the gear, and the other along the line of the bottom of the teeth. This must be an acute angle. Place one arm of the bevel parallel with the edge of the planer table, and parallel with the other arm set that edge of the dividing head which is parallel to the axis of the mandrel. When the head is set the slotting tool is inserted and cutting commenced.

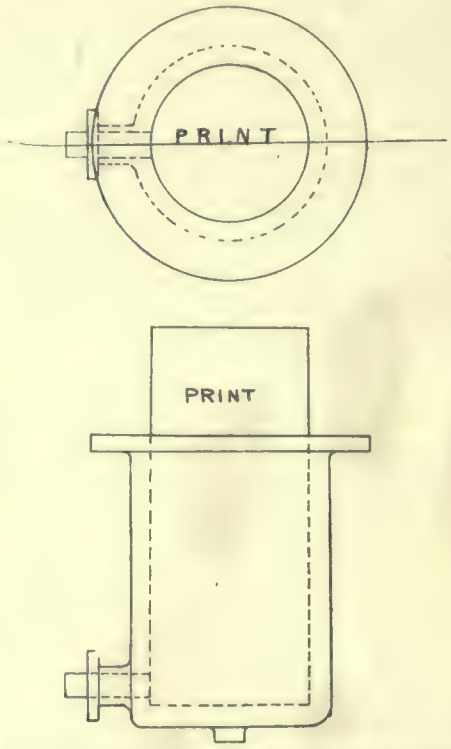


Fig. 1—Molding small cylinder in green sand.

The size and shape of this tool is governed entirely by the profiles of the small ends of the teeth. When the blank is slotted, the angle of the "head" is slightly changed so that the point of the tool, when fed down to the pitch circle at the large end, will be only down to the pitch circle at the small end when it reaches that end of the cut. The cutting edge of this tool has to be very carefully ground and great care taken with the clearance, to secure a smooth surface. Both sides of the tooth faces are finished as in a spur gear.

To cut the flanks, or that portion of the teeth below the pitch line, we must alter the position of the head, by placing it at the same angle as when the first slots were planed. The finishing cuts are taken as already explained. There is one point, however, to be noted. The fillet in the bottom of the tooth will be uniform, and its size is governed by the pitch of the tooth. Thus, it must not be larger than that which is allowable at the small end of the tooth.

**Practical Considerations.**

There are one or two points which come up in practice that one would do well to consider. In spur gears, the cutting edge of the tool should be on a height corresponding to the height that the axis of the bore is above the table. In bevel gears, when cutting the faces, the tool should be very slightly below this to insure the points of the teeth not being over size, and, thus, when in use, assuming an undue portion of the load. The tool when cutting the flanks should also be slightly above in order to give the tooth all the strength possible at the root.

With care, an approximately accurate gear may be cut if the face of the gear is not too great, and if the face exceeds certain limits, the number of cuts across the face may be increased. Three cuts, however, is a limit, as at best, the gears, being more or less only approximately cut, cannot be marketed as the perfect article.

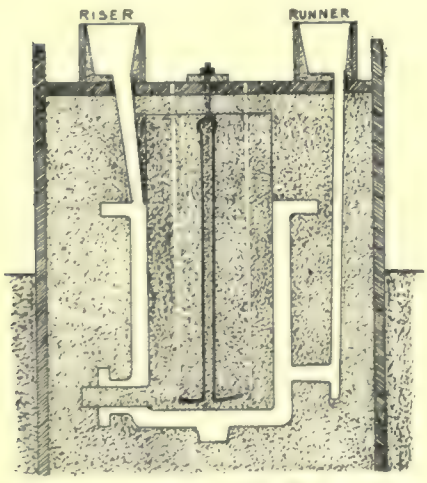


Fig. 3—Molding small cylinder in green sand.

## MOLDING A SMALL CYLINDER IN GREEN SAND.

By John H. Eastham.

THE small cylinder shown at Fig. 1 whilst of exceptionally plain design, gave trouble in the machine shop as a result of being cast horizontally. Hard spots developed round the chaplets, which were necessary on account of the casting being open at one end only. In addition, the bore, whilst fairly clean, proved to be one-eighth of an inch out of centre at the closed end.

In view of these defects the foreman decided to cast future pieces vertically, without studs or chaplets of any kind. The method of molding the cylinder and securing the core was as follows:—One-half of the pattern was rammed-up on a board and turned over in the usual way, provision being made in the flask at the coreprint end for a runner, riser and hook bolt to pass through, the latter to act as a suspender for the core. An iron

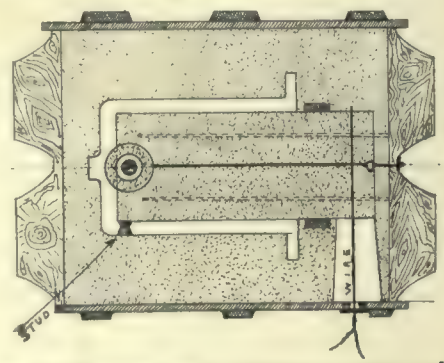


Fig. 2—Molding small cylinder in green sand.

bearing plate was rammed-up on the coreprint to prevent the possibility of a crush when placing core in position. The parting being made, cope rammed-up, and both half patterns drawn, the mold received the necessary finishing and blackening. A spool-shaped stud of correct depth was next placed as shown at Fig. 2, and a hole dug in the coreprint down to the bottom board.

The core was now placed in position, a length of flexible strong wire being bent over the print and passed down at each side through the board and twisted securely round a bar. The hook bolt was next looped around the eye in the end of the core iron, and bolted tightly to the end of the flask, the core being thus made practically immovable.

The stud was next removed, the cope lifted on and clamped, the mold turned-up into a pit, and rammed round to about two-thirds the depth of the casting. This was to prevent any strain or risk of a runout.

Fig. 3, of the mold ready for pouring, is self-explanatory, and shows the hook bolt arrangement, also the methods of gating and rising. The use of a good quality iron, poured at a high temperature, combined with the above safeguards gave excellent results, whilst the absence of chaplets prevented the risk of leakage so often shown in similar cases.

# Mechanical Drawing and Sketching for Machinists

By B. P.

*A Series of Progressive Lessons Designed to Familiarize Engineers With the Use of the Apparatus Necessary to Make Simple Drawings, to Encourage Them to Realize How Important a Factor it is of Their Equipment, as Well as Being a Profitable Pastime.*

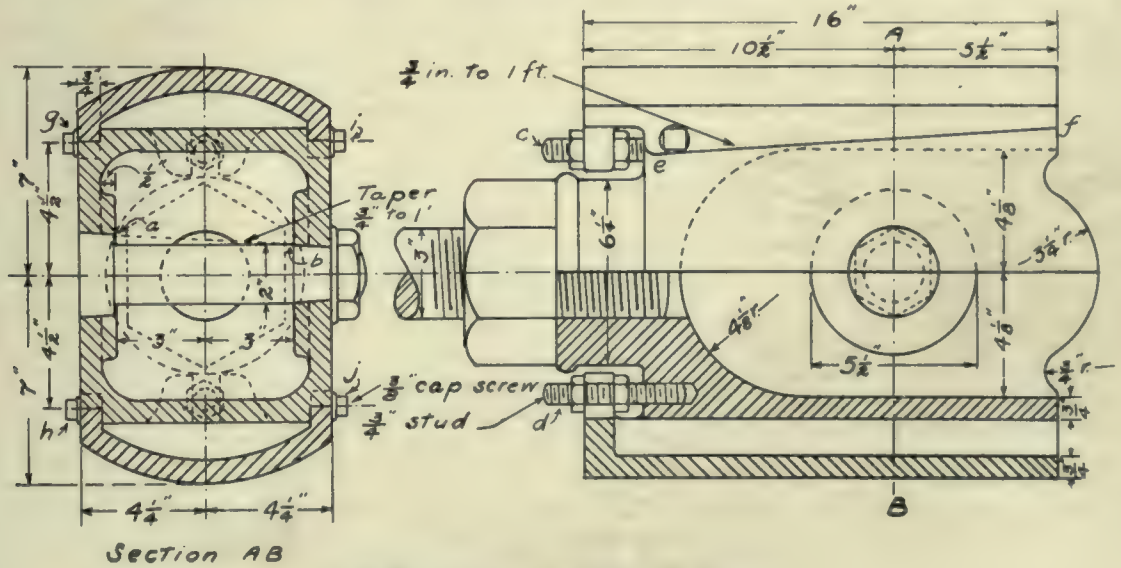
WITH this lesson we conclude our course in drawing, which has extended over a period of fourteen months. Thus, many of these ideas and suggestions will not only refer to the drawing of the crosshead, herewith, but in a general way to all drawings.

### Crosshead Drawing.

This crosshead is taken from a high speed piston valve, steam engine, and was selected because of its extreme simplicity, although, at a first glance, it may look rather complicated. Several dimensions are, again, purposely omitted, to allow the student to develop his ingenuity and fill in. When proceeding with the drawing, it will readily be seen how many dimensions are required to make it complete. There are but two views: a side and end elevation. It is sometimes necessary to have a plan view, but in this case nothing would be gained by the addition of the latter. The side elevation shows the lower half of the cross head in section, while the entire end elevation is a section through the centre of the wrist pin. These two views show every detail of construction.

To start this example, it is necessary to first draw our centre lines. The wrist pin is the base about which the crosshead is constructed, and thus it is naturally the part to which we next devote attention. Let us place it in the side elevation first; projecting it afterwards over to the end elevation. The outside outline of the crosshead in this view is next filled in and projected across to the side elevation. Some lines are a great deal more readily obtained on one view than on another, and, with practice, the student will soon be able to see just where certain irregular outlines and points are found with the least labor. Having found them on one view, it is a simple matter of projection to locate them on the others; two or three views being, thereby, constructed simultaneously. When this method of attack is followed, a rather complicated drawing will soon be completed, and the student will often wonder why it is that some mechanics have difficulty in making a drawing from a free hand sketch obtained in the shop. Further, it makes him able to understand more complicated drawings quite readily.

Originality is a great asset in this work, some possessing it to a greater degree than others, but the ability to illustrate thoroughly any particular machine or part of it with the fewest number of views, cross sections and detail drawing is what every mechanic and prospective draughtsman should cultivate, even before speed is considered. Accuracy is another important matter, and too great attention cannot be paid to it especially in drawings and tracings of new machines. In completing the drawing of this crosshead, there is really no comment to make. Each difficulty, if




Crosshead—Mechanical Drawing and Sketching.

approached in the proper manner, will disappear, and in a remarkably short time, the drawing will be complete.

The wrist pin, as will be noticed, is tapered at both ends. The taper is three-quarters of an inch in one foot on the diameter. The pin is only turned tapering where it fits in the metal of the crosshead frame. However, both portions have been turned at one setting, and are parts of the same cone as is indicated by the dotted line from "a" to "b." The method of taking up the wear is that usually employed; two studs of ¾-inch dia. machinery steel being placed in the body of the crosshead as shown at "c" and "d" respectively. The top and bottom pieces are fitted to the body along inclined ways, as shown through "e f." A small lug is cast on each end of these shoes, and the steel stud enters an open slot in this lug. Two lock nuts, one on either side of this lug, adjust these shoes. Four little ⅜-inch cap screws, "g, h, i, j," respectively, pass through inclined slots in the shoes to the body, and hold the two together. The other details of the construction are self evident.

**Concluding General Suggestions.**

Before concluding, perhaps a few general suggestions that the student might do well to always bear in mind, would not be out of place. Dimension all drawings thoroughly. Very little can be said about the best methods of accomplishing this, as drawings are of such a varied nature. Try to arrange all dimensions in conspicuous places, and when it is necessary to subdivide them into several smaller units, place the smaller ones all in a single line nearer the outline than the over-all figure. Do not repeat dimensions on the same or different views unless for some special reason, and never allow your dimensions to be of such a nature that it would entail calculation or figuring on the part of the machinist. He is much more apt to make an error than you. Place the arrow-heads so that there will be absolutely no room for doubt as to what they refer. Make all dimension and limiting lines considerably thinner than the outline, but yet distinct. This also applies to centre lines, which should never be used as dimension lines. Instead of repeating a series of sizes, such as a number of bolt pitches, dimension two or three spaces and fill in the remainder as follows: Seven spaces at 3-inch each — 21 inches. When a fraction is used, always place the numerator directly above the denominator, and have them separated by a horizontal line. This prevents any chance of its being misread after the drawing has been in service for some time.

There is a limit beyond which dimensions should not be expressed entirely in inches. Each shop has its own limit, which varies from 24 to 100 inches. If a dimension is expressed in feet and inches, always make a liberal dash between the two sets of units, as 11 ft.—4½ in., otherwise it might be mistaken for 114½ in. When a dimension is an even number of feet always express as 17 ft.—0 in., to prevent mistakes from creeping in. In tracings from which blue prints are to be made, all lines should be made somewhat thicker to ensure good copies. When a drawing does not show up well, it is good practice to shade it. Make all similar lines of uniform thickness.

If a note on a drawing will explain a detail as well or better than a detail sketch, do not hesitate to use the note. Put yourself in the place of the man who is to work from your drawing.

It is a good plan to always place the title and necessary date in the same place on every drawing. The lower right hand corner will be found quite as convenient as any. Always use a convenient scale, and do not fail to have it plainly and prominently marked. Your choice should be the largest possible while keeping the drawing within reasonable limits. A hard pencil, kept well and properly pointed, should always be used.

A great many rules can be quoted, but cases will arise wherein the observance will be more satisfactory in the breach. We can only advise, therefore, a student to exercise his own common sense and originality, and in the measure that he does this his success will be assured. Suppose it is required to represent an engine connecting rod, and we wish our drawing to be not more than 24 inches long. For an assembled view of a large connecting rod, we should be required to use an extremely small scale, the details would be hard to represent and the drawing would be more or less unsatisfactory. To better represent this rod, make a detail drawing of each end to a comparatively large scale, and an another portion of your sheet make an assembled drawing sufficiently large to supply all details which may not be shown in the views of the two ends.

When a cross section is shown, if there exists more than one metal, the hatching should make this conspicuous. Conventional representations of screws and other details more or less difficult to represent, should always be resorted to and an explanatory note placed upon the drawing, if necessary.

With these ideas we hope the student may not only be able to intelligently understand a shop drawing, but with a little practice be able to make one himself.

## ASSOCIATION FOR INTERNATIONAL EXCHANGE OF STUDENTS.

This association, which has organized an important conference for the end of June, to be attended by representatives from nearly every English-speaking University, the High Commissioners and Agents-General for the Dominions, delegates from the principal Chambers of Commerce, and others, has arranged a tour through the Dominion of Canada and the United States, of special interest to engineers and engineering students. The party will visit all the most important engineering works along the route, will be received and given information by commercial and industrial leaders in every sphere of activity and members of various governments. An important point is that the party is limited to ten people, to allow of specialization in particular subjects by individual members, and to enable it to be informative in the best sense. The itinerary will include Quebec, Montreal, Ottawa, Toronto, Cobalt, Sarnia (St. Clair tunnel), Chicago, St. Paul, Winnipeg, Regina, Calgary (railway constructon at nearest point), Banff and Laggan, Vancouver, San Francisco, Grand Canyon, Santa Fe, Laguna (Indian reservation), Pueblo, Denver, Golden, St. Louis, Pittsburg, Washington, Philadelphia (Cramp yards, etc.), New York and Boston, if desired. The party will be accompanied by a member of the Association who knows the countries visited, intimately. Further particulars can be obtained from the hon. secretary of the Association for the International Interchange of Students, at Caxton House, Westminster, S.W.

## LARGE STEEL INGOTS.

Messes. Cammell, Laird, & Co., Ltd., have just turned out two very large steel ingots at their Grimesthorpe works, Sheffield. One of them weighs nearly 140 tons, and will form the base of an armor-bending or straightening press for a neighboring firm. It was cast from three furnaces, then reheated and placed under the 4,000-ton hydraulic press, in which its thickness was reduced from 4 ft. 6 in. to 3 ft. 6 in., and the top end, weighing about 40 tons, was cut off. After being again reheated, it was rolled down in the armor-plate mill to a thickness of 2 ft. 7 in. The second large ingot is an octagon of 137 tons, for a gun jacket.

**R. H. Noble**, who was employed by the Canadian Fairbanks-Morse Co. previous to his entering the organization of the Positive Clutch & Pulley Co., Toronto. has accepted a position with and now has charge of the transmission department of the Canadian Fairbanks-Morse Co., at Toronto.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## MODERN FOUNDRY PRACTICE*

By Hugh Munro, B.S.c., M.I., Mech. E.*

### Molding.

NEARLY all castings are molded in sand molds. Of late a good many founders have experimented with permanent molds of cast iron for articles of which a large number is required. It is usually considered that castings made in iron molds are chilled and are very difficult or impossible to machine. This is not always the case. If the casting is allowed to cool in an iron mold it becomes very hard, or even white, but if it is withdrawn from the mold as soon as it will bear handling and is allowed to cool slowly, it does not become nearly so hard.

Permanent cores of cast iron are also used in a few foundries, and there is said to be no trouble in extracting them, provided they are drawn immediately after the metal has solidified. In using iron permanent molds, the molds must be warmed up to some extent before good castings can be produced from them, and the first half dozen castings are usually wasters. While on this subject of permanent molds, I may say that die castings made by injecting fluid metal into steel molds are quite common and can be made almost as exact as machine work. These castings are composed mostly of alloys of tin, lead, zinc and antimony; permanent molds for cast iron are still in their infancy.

Practically speaking, therefore, all castings are made in sand molds. The sand must have sufficient "bond" or cohesion to retain the shape of the pattern until the iron is poured, and it must also be sufficiently porous to allow all gases to pass freely away and leave a smooth skin on the resulting casting. Molds are made either in green sand, dry sand, or in loam.

### Green Sand.

Green sand, so called because the mold, after drawing the pattern, is not dried in any way before the metal is run into it. This sand is mixed with a small proportion of coal dust, the object of the latter being to obtain a smooth skin on the casting and to prevent the sand sticking to it. It is most important to get the coal dust thoroughly incorporated with the sand, and for this purpose various mixers are used. The most successful are those of the centrifugal type.

### Dry Sand.

Molds made in dry sand are dried in stoves or on the floor by special driers after the pattern is withdrawn from them. The mold is covered with a wash of blacking in order to give the casting a smooth skin and prevent the sand sticking to it. Coal dust is not mixed with this sand.

### Loam.

Molds are built up of bricks and clay with iron plates to give the walls rigidity. The pattern may be complete and the mold built around it, or, if the casting is cylindrical in shape, part of the mold may be swept up by revolving boards or formers and the other sections made with skeleton patterns. Intricate and important castings of large size are usually made in loam. Complete patterns are necessary for both dry sand and green sand. In loam work, a few boards are frequently all that is necessary if the casting is of such a shape that it can be swept up. Ordinary molding sand should not contain more than 14 per cent. clay, 5 per cent. iron oxide, 1.5 per cent. lime, 1 per cent. organic matter. Silica should run from 75 to 85 per cent.


**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**


### Cores.

The proper construction of cores is of more importance than that of any other part of the mold. They are surrounded by metal, and they must be well vented in order that the gases generated in the sand may pass freely to the atmosphere. Cores are occasionally made in green sand, but more often in dry sand or loam. The sand should give off a minimum of gas, and it should be such that it may be easily cleaned out of the interior of the casting.

Of recent years many core compounds, or binders, as they are called, have been invented for mixing with sand to form cores. Linseed oil is one of the best core binders, but it is expensive. Resin, flour, and molasses are also good. Several very good binders which contain glucose compounds are now sold. These core compounds are mixed with ordinary sharp sand, and bind it together without any other ingredient, but a small amount of clay water is usually added. The great advantage of these core binders, such as linseed oil, is that they give off very little gas; they do not require core iron to stiffen them, and they bind the sand long enough until the iron solidifies. The heat burns up the binder, and the sand is easily cleaned out.

### Preparation of Molds.

In a foundry, more skilled labor is employed in preparing molds than in any other operation, and it is here that most attempts have been made to cheapen production. Where there is a moderate amount of repetition work, a very effective way to reduce labor costs, and a way which requires very little capital expenditure, is the adoption of plate molding. Here the pattern for each half of a mold is fixed on a flat plate. The plates are made to receive the guide pins of the molding boxes, which are all interchangeable. All the bottom parts of the molds are laid down first, the cores inserted, and the top parts put on afterwards.

It is, however, by the adoption of machine molding that the greatest economies have been attained in most foundries. Molding machines may be worked by hand or power, and, generally speaking, they may be nearly all included in two leading types: (1) Machines which ram the mold and draw the pattern. (2) Machines which draw the pattern, the mold being rammed by hand.

### Ramming Machines.

Ramming is done by squeezing the sand into the mold by hydraulic or pneumatic power, or by jolting. In the latter type of machine the molding box is filled with sand, the table of the machine is then raised and allowed to drop

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*Continued from March issue of Canadian Machinery.

**Superintendent, Glenfield & Kennedy, Kilmarnock, Scotland.

smartly several times on an anvil. The sudden stop causes the sand to consolidate around the pattern. In order that this machine may be a success, the chief requisite is a massive anvil and a good foundation, but a form of jolt machine has recently been introduced in which no foundation is necessary.

Hydraulic machines usually ram the sand by one or two slow squeezes, while pneumatic machines ram it by several smart blows. Ramming molding machines are a success in flat, plain work, but where the mold is deep and the pattern intricate, some of the sand must be rammed by hand and the final squeeze given by the machine. The jolt ramming machine is said to ram the sand evenly all over deep and intricate patterns. As a matter of fact, the deep parts are rammed harder than the shallow places, and the sand at the bottom of the box is rammed harder than that at the top, owing to the weight of the extra sand above it. In a hydraulic or pneumatic machine, on the contrary, the top of the box is rammed harder than the bottom, and the shallow parts harder than the deep places.

### Pattern Drawing Machines.

In very intricate work, the whole of the ramming may be done by hand, and the machine is then only used to withdraw the pattern from the mold. In drawing the pattern from the mold, it is of the greatest importance that the sand should be left absolutely intact and of the exact shape of the pattern. Except where the pattern is thin and has plenty of draft, precautions must be taken to prevent the sand adhering to the pattern or breaking away at the corners of the mold. In ordinary molding, the pattern is sprinkled over with some parting sand, which prevents the molding sand sticking to the pattern, and the pattern is rapped to loosen it before being withdrawn.

On molding machines, various devices are in use to enable the pattern to be easily and quickly withdrawn without injury to the mold. Cast iron patterns draw out of the sand more easily than brass or wooden ones, and both brass and iron patterns draw out more easily if they are kept warm, or if rubbed sometimes with paraffin oil. Pneumatic machines are furnished with a vibrator, which shakes the pattern very slightly and loosens it from the sand. Many pattern drawing machines are furnished with a stripper plate, which is a flat plate having a hole in it the exact counterpart of the outline of the pattern. The pattern is drawn through the plate, and the sand by this means is preserved intact. Thin patterns with plenty of taper or "draft," may be quite easily withdrawn without a vibrator or stripping plate, but deep patterns with intricate outline and little draft must either be vibrated or drawn through stripper plates.

At first sight it does not seem of much importance whether the pattern is drawn down from the mold, or the mold drawn down from the pattern. Both methods are in use, but it is more satisfactory to draw the pattern from the mold in such a way that the box may, during and after the operation, lie with the interior of the mold upwards. If a piece of sand adheres to the pattern it usually drops back into its place when this method is followed. The workman can at once examine the face of the mold and see that it is all in order, and that no parts are broken away. Where the mold is a very simple one the workman should not be allowed to patch up any defects in it. The sand should be knocked out, and a new mold rammed up.

Most molding machines ram the mold, turn it over and draw the pattern. Some of them simply draw the pattern down from the mold. Many others have a revolving table with the pattern for the bottom of the mold on one side and the pattern for the top on the other side of this table. The procedure is as follows: A box is clamped on the top side of the table, filled with sand, and rammed. The table is now turned upside-down, a box clamped on the other side, which is now the top side, and rammed. The first rammed box is then dropped from the pattern, withdrawn, and placed on the floor, when the table is again turned upside down, and the process goes on. On this type a complete mold may be made on one machine and each mold is finished before another is started, the top and bottom parts of the mold being made alternately. When the table does not revolve, the machine only carries one pattern. All the bottom parts of the mold are made first, and laid down; then the pattern is changed, and all the top parts are made and the molds finished off. Again two machines of this type may be used, one man making all the bottom parts, and another making all the top parts, while a third may be employed in placing cores in the molds and preparing them for casting.

In addition to the types already mentioned there are, in the United States, some machines in which the sand is consolidated by letting it fall into the mold from a height, or it is thrown into the mold with considerable force by other means. It is claimed that in this way the sand is equally rammed all through the mold.

### Columns Cast on End.

Columns for building purposes are usually cast horizontally. Made in this manner the top side of the casting is weaker than the lower side, due to two causes: (a) The core tends to rise and make the top side of the casting thinner than the other; (b) All the dirt rises to the top or thin side.

Columns carrying heavy loads should be cast vertically. Rams for hydraulic cranes and accumulators are always cast on end. This insures clean metal of uniform section throughout the casting. The dirt rises into a "head," which is afterwards cut off. My firm make a specialty of cast iron columns cast on end, and have obtained the following tests from the metal used for this purpose:

65 tons per square inch in compression taken on cubes ½ inch square or ¼ square inch in area, and 13 tons per square inch tensile.

### Defects.

The defects to which cast iron is subject, and which may render a casting useless, are numerous. The chief are as follows:

(1) Shrinkage defects.
(2) Blow holes—pin holes.
(3) Sand holes—slag holes.
(4) Hard spots.
(5) Cold shuts.
(6) Scabs.
(7) Irregular and rough surface.
(8) Out of section.

Shrinkage defects were dealt with under shrinkage.

**Blow Holes**—A blow hole or air hole is a hollow cavity in the metal usually having smooth walls of a bluish color, and as a rule it is quite empty. Blow holes occur mostly directly under the skin of the casting, but sometimes they are found throughout the whole section. The former are caused by the sand being too damp, too hard rammed, or badly vented; in either case the gases generated by the heat not finding a free escape through the sand are forced into the metal and form these cavities. Blow holes throughout the metal are probably caused by the metal having been cast too cold. It is doubtful if liquid cast iron occludes gas and gives it off during solidification. I am inclined to think it does not.

Chaplets (which are used to keep cores in position) are a fertile source of blow holes, especially if they are rusty or damp. They ought to be coated with pure tin, but often they are coated with an alloy of tin and lead or zinc, which is as bad as rust for causing blow holes.

The causes of blow holes are: Sand too wet; sand too hard rammed and badly vented; rusty or wet chaplets; air trapped in iron while pouring; gases generated in the iron while fluid, and possibly occluded gases.

**Pin Holes**—These are minute holes which appear on the surface, and often extend almost through the metal. They seem to proceed from a small piece of slag or oxide in the body of the metal from which gas is being generated by some chemical action. This gas forms a

small passage outwards for itself, and continues blowing through it until the iron has cooled, the result being a pin hole. It is said that iron high in sulphur is particularly subject to pin holes. I have tried the addition of manganese in order to prevent pin holes, but it had no appreciable effect.

**Sand and Slag Holes**—The cause of these is self-evident, either loose sand in the mold or slag entering the mold along with the iron. The mold should be thoroughly clean before being closed, and the iron should be well skimmed when pouring. When iron is being poured into a mold, some of it, of course, oxidizes. Oxide of iron has never, so far as I know, been found in cast iron. The oxide formed while pouring is probably reduced by the silicon present, and forms small particles of slag throughout the metal, and this slag may be seen under the microscope.

**Hard Spots.**—Hard masses of iron are sometimes met with when machining cast iron. These hard spots take the form of globules, which are sometimes covered with a skin of oxide; they are usually not united to, and may even be quite loose from the rest of the metal. They are sometimes found thoroughly united to the softer iron. These globules are said to consist of iron high in phosphorus, but more probably they consist of white iron which has been charged into the cupola along with other scrap and has not mixed with the rest of the metal during melting.

**Cold Shuts.**—When iron flows in a stream along a mold the advancing front gets covered with a thin film of oxide. If this stream meets another advancing towards it the oxide skin prevents the two streams uniting. The defect thus formed is called a "cold shut." It is often impossible to distinguish a cold shut in cast iron, but a water test soon shows it up. Globules of metal with a film all around them are often formed in castings, and, as they do not unite with the metal around them, the casting is thus weakened at that point. These globules are similar to those described under hard spots, but, except that they are soft, they do not differ from them, and are caused by a portion of iron becoming oxidised and subsequently not uniting with the rest of the metal.

**Scabs.** When part of the skin of a mold breaks away, which sometimes happens before the iron is poured into the mold or during that operation, the iron, of course, fills the place when the sand has fallen off, and forms on the casting a rough ugly lump called by molders a "scab." It is usually chipped off and does no harm to the casting, but the sand which has broken away must be somewhere in the mold, or, if a head is on the casting the sand will probably rise up there. Scabs are caused by bad venting, hard ramming, damp sand, or the mold crushing when being closed. When a flat plate is being made in green sand, the iron radiates heat to the top of the interior of the mold, and gas is generated in the layers of sand just behind the skin of the mold. If this gas, owing to defective venting, does not pass freely out of the sand, it blows back into the mold, taking some of the sand with it. To prevent this, all the risers in such molds are kept closed, so that the air inside is compressed. Gases generated in the sand cannot thus pass into the mold, but must flow outwards to the atmosphere while the compressed air inside exerts a slight pressure on the interior surface and prevents it collapsing.

**Irregular Surface.** When a casting has a lumpy, irregular surface, it is an indication that the mold has been rammed hard in some places and soft in others. A coarse, dirty skin on a casting is caused by the metal being poured very hot, or by a poor quality of facing sand or blacking.

When cores are placed in a mold they are kept in place by chaplets and by core prints. Sometimes the iron causes the core to float upwards, and then the metal on the top of the castings becomes too thin. This defect is very common in pipes and columns cast on their side.

### Foundry Equipment.

The equipment of a modern foundry may assume a great variety of forms. If we consider a foundry doing general work of considerable weight, the chief consideration is quick and powerful cranes. Overhead electric travelers are used for dealing with heavier lifts and for traversing material through the shop, while wall cranes are used by squads of molders for handling boxes and molds. Cranes for foundry purposes should have facilities for specially slow handling of weights when important molds are being closed and cores placed in them.

In a foundry doing much light repetition work, the equipment consists of apparatus for dealing with sand and for getting iron promptly from the cupola to the molds. This latter is most important, as hot iron is an absolute necessity in light work. One of the most approved ways is an overhead runway, but ladles drawn along gangways throughout the foundry are equally common.

Drying stoves for molds and cores are usually fired by coke, and sometime? by producer gas. Coke is nearly always used. Gas fired stoves are easily controlled, and give a more uniform heat. The cost of coke and gas is about the same. Drying stoves nearly always open from the foundry direct, but this allows all the fumes and smoke from the stove to enter the shop. The stoves should be set back about 3 or 4 feet from main building, and both stove and foundry should each have independent doors. When the stove is being filled or emptied, both doors are open so that the smoke and fumes from the stove instead of coming into the shop ascend outside it.

The heating of a foundry is important in frosty weather. Molding sand for green sand molding contains a certain amount of water, and if this water freezes, the sand is useless for molding purposes for the time being.

The methods of cleaning castings are not greatly different now from what they were 20 years ago. The chief advance has been in the use of sand blast for cleaning out small intricate castings. These may be put into a revolving barrel and the sand directed to them there or they may be placed in a closed room and a man directs the sand on them through a nozzle. Pneumatic hammers have not been found of much service in dressing castings, as the amount to be chipped off varies to such a great extent. The old-fashioned revolving barrel holds its own against most modern methods.

### Constituents of Cast Iron.

Iron for any particular class of castings is chosen most frequently by the appearance of the fracture. This method has produced excellent results in the past, and was a very good way when used by experienced men. Owing to the introduction of hot blast for blast furnaces, and harder driving, there is greater variation in the pig iron produced now than in the past, and fracture is not so reliable a guide to quality as it once was. It has been found that irrespective of the fracture, the chemical composition of the iron he uses is of great importance to the iron founder. The effect of certain of the constituents of cast iron is now fairly well known, and by properly proportioning these, more or less definite results may be obtained. Our knowledge of the influence of those constituents is to some extent deduced from investigation into their influence on iron in the form of steel. It does not necessarily follow that they affect cast iron in the same way, or to the same degree, as they do steel, although in some of the literature on cast iron this seems to be assumed by the writers. Moreover, the influence of any one constituent is usually modified by the relative proportion of other elements present, but what is stated here is accepted by the best authorities to be the result which may be expected from the different elements.

### Effect on Cast Iron Due to Variation in Its Constituents.

Cast iron consists of the following elements in varying proportions:—Iron, carbon, silicon, sulphur, phosphorus, and manganese.

**Carbon.** Pure iron can only be melted with difficulty, but the presence of carbon (of which it is capable of holding in solution up to 4 per cent.) makes it comparatively easy to melt. At high temperatures it can hold more, as much as 4.5 per cent., but as it cools down, the excess separates out and collects on the top of the fluid metal in the form of "kish," which is often seen on pig iron, but not much of it is produced in the foundry. Ordinary foundry iron seldom contains more than 3.75 per cent. of carbon, and it exists in two forms, as combined carbon, and as graphitic carbon. Iron high in combined carbon melts at a lower temperature than iron with a high percentage of graphitic carbon. The former, however, is not so fluid as the latter, and it passes through a pasty stage in melting or solidifying. Combined carbon hardens iron and increases shrinkage; graphitic carbon has the opposite effect. With the latter, there is less tendency to blow holes and draw holes than with the former. An iron high in graphitic carbon is usually more satisfactory in the foundry so far as melting and casting is concerned. On the other hand, an iron low in graphitic carbon and high in combined carbon is much stronger.

**Silicon.** The direct effect of silicon on iron is obscure. It, however, acts indirectly on the iron through carbon in a very marked manner. Other things being equal, increase of silicon tends to force carbon from the combined form into the graphite form, thus softening the iron and decreasing shrinkage. It also weakens cast iron, and makes it more fluid. Silicon in molten iron readily unites with oxygen. When iron oxide gets into a mold along with the molten iron some of this oxide is reduced by the silicon and minute globules of slag are formed which are trapped in the solidifying metal, and quickly wear off the edge of cutting tools. If a soft easily machined metal is wanted, it is better to attain softness by graphitic carbon only than by graphitic carbon and high silicon. Silicon in the absence of carbon is said to harden iron.

**Sulphur.** Sulphur hardens iron and is said to increase shrinkage. It is usually considered injurious to iron, but it improves heavy thick castings when present in quantities up to .25 per cent. When not exceeding this amount it increases the strength of thick castings but the proportion should be much less if the castings are thin. Sulphur has a tendency to prevent carbon assuming the graphitic form.

**Phosphorus** makes iron more fluid and apparently reduces shrinkage. Up to 1 per cent. or 1.3 per cent. it does not seem to affect the strength of cast iron greatly, although in very small proportions it has a bad effect on steel. A larger proportion of phosphorus than the above weakens cast iron very considerably. A phosphide of iron is formed which surrounds each individual crystal of iron and prevents them uniting as they otherwise would.

**Manganese** increases the capacity of iron to absorb carbon, and has a tendency to make the latter take the combined form. It hardens the iron and increases shrinkage, and when present in proportions of .8 to 1 per cent. it improves thick castings. Aluminum is sometimes used in small proportions in cast iron, but does not seem to be of much benefit to it. It appears to have the same effect as silicon but in a lesser degree. It tends to make carbon take the graphitic form.

### THE LATE RICHARD R. MITCHELL.

Readers of Canadian Machinery will learn with regret that Mr. Richard Ramsay Mitchell, president of the Robert Mitchell Co., Ltd., Montreal, died on February 8, at his residence there. The deceased gentleman was born at Montreal in 1864 and received his education at the High School of that city. On leaving school he served an apprenticeship in the various shop and office departments of the Robt. Mitchell Co., and subsequently became a member of the firm. In the year 1896, the business was incorporated, and on the death of his father in the following year, Mr. Mitchell became president.

The late Richard Ramsay Mitchell.

As a governor of the Montreal General and Western Hospitals and Board of Trade, Mr. Mitchell was well known and highly respected, while among those more directly interested in the foundry business, his vice-presidency of the American Brass Founders' Association indicated his personal worth and recognized executive ability. To those who were fortunate enough to know Mr. Mitchell in a social or business capacity, the news of his death comes with a double shock, for his generous disposition and hospitable manner will always be remembered.

### GOOD MACHINES ATTRACT GOOD MEN.

A manufacturer of machinery, who has converted an old-time machine shop into one of the highest efficiency in methods and equipment, asserts that good machine tools bring good workmen. In his experience, which includes that of the evolution from the old-fashioned to the modern, he has found it very much easier to hire high-class workmen when they know they are to operate high-class machines. Probably one reason for this is that desirable men take pride in their work and want the best equipment with which to do it. A glance in the tool chest of a good machinist proves this statement, for he usually has an elaborate, well-cared-for kit of small tools and instruments. The man who is particular about his own tools must be attracted by modern machinery. Oftentimes he rates his chance of advancement by the amount of work he can produce, and the better the machine the greater the volume and the more satisfactory the product. Improved manufacturing facilities thus constitute an element which should not be disregarded in the general aim to secure efficiency.

### A NEW MICROMETER.

A NEW micrometer that will be of interest to all machinists is being put on the market by the J. T. Slocomb Co., of Providence, R.I. It is an inside type for measuring one-half to two inches. There have been on the market for some time micrometers for making inside measurements, two inches and above, but a common method of making inside measurements, smaller than this, was by use of an inside caliper in conjunction with an outside micrometer. This at best was, of course, unsatisfactory. The J. T. Slocomb Co. are putting these tools up in sets containing inside micrometers only and also in sets containing their regular outside micrometers in addition.

## MOULDING AN AIR CHAMBER COVER IN LOAM.

By J. H. Eastham.

THE air chamber cover, Fig. 1, was one of a set of condenser castings recently ordered. The contract price

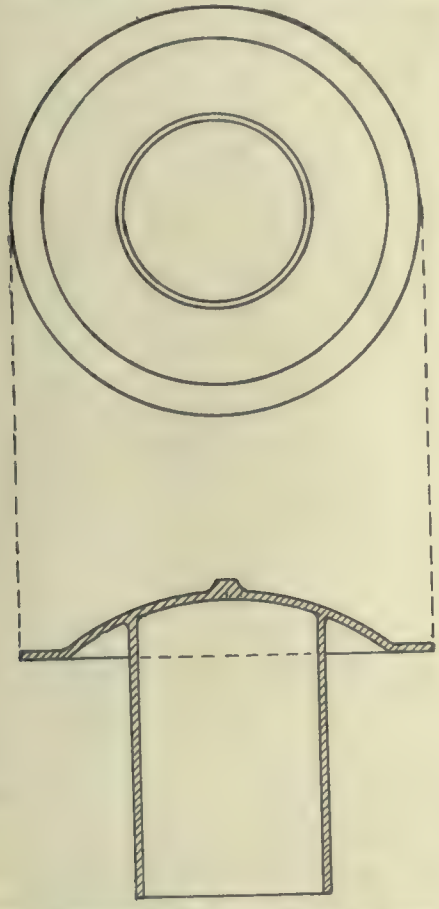


Fig. 1.—Molding air chamber cover in loam.

necessitated economy in patternmaking. therefore, this casting in common with others, was made in loam, the procedure being as follows.

Over a circular baseplate, several inches wider than the full radius of the casting, the sweep shown at A, Fig. 2. was set, brickwork being built up close to its under edge, and the outside or top face of the casting struck-up. When this, the plainest section of the mould was finished and run into the stove, the prodded plate B.B., Fig 3, was laid level, and the sweep, C.C. employed to strike-up the under side of the flange to match the section shown in Fig. 2. After being

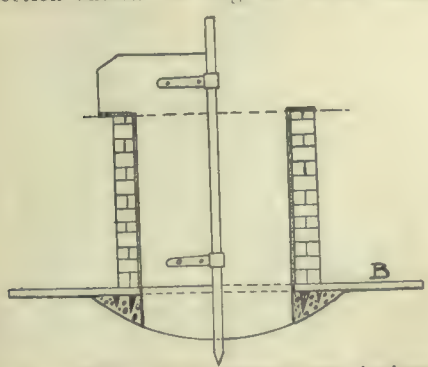



Fig. 4.—Molding air chamber cover in loam.

skin-dried, this plate was turned over, the full height of the casting built-up on

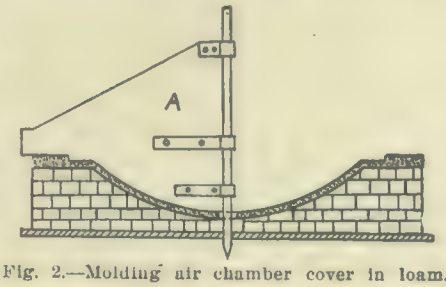



Fig. 2.—Molding air chamber cover in loam.

its reverse side, and swept-out by sweep D, Fig. 4; the outside or cheek portion of the mould being thereby completed.

The core was next built up on the cope plate E.E., Fig. 5, a binding plate F,

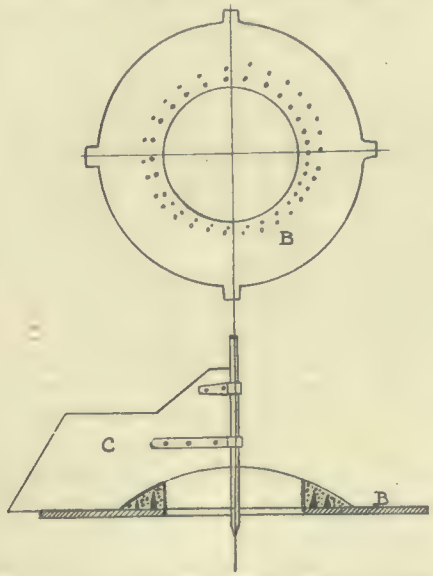



Fig. 3.—Molding air chamber cover in loam.

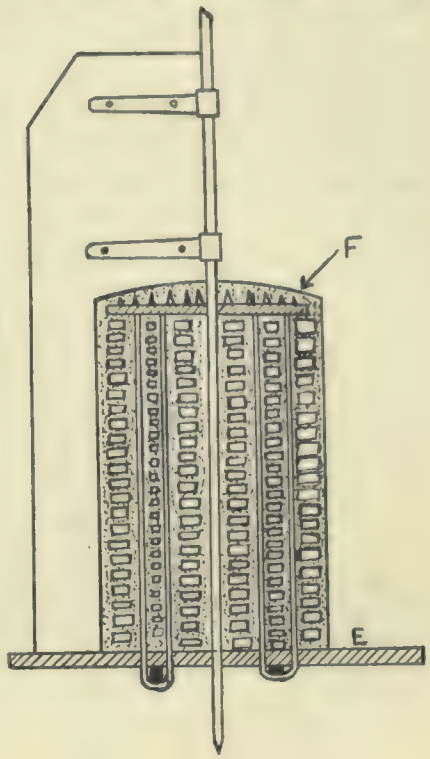
fitted with wrought iron loops being laid on the brick work and wedged to the cope to ensure rigidity. When closing the mould, the base plate was set in the floor to its full depth and rammed round tightly, the cheek being afterwards lowered to position. The cope plate, with core attached, was then tried on, the cheek fitted round with cribbing plates, and rammed-up in the ordinary way. On account of its unusual shape, weights were used to hold down the mould while pouring, the method of gating being shown in sketch of finished mould, Fig. 6.

## FOUNDRY CONCERNS IN BIG MERGER.

J. A. MacKay & Co. have announced completion of the formation of the Canadian Foundries and Forgings, Limited, with the following capitalization:

| | Authorized. | Issued. |
|---|---|---|
| Common stock ... ... | 1,250,000 | $960,000 |
| Preferred, 7 p.c. ... | 1,250,000 | 960,000 |
| Bonds, 6 p.c. ... ... | 500,000 | 67,000 |

This company consists of the James Smart Manufacturing Co., Ltd., Brockville, the Canadian Billings & Spencer, Ltd., and the Canada Forge, Ltd., both of Welland. The last two firms have been carrying on business for about five



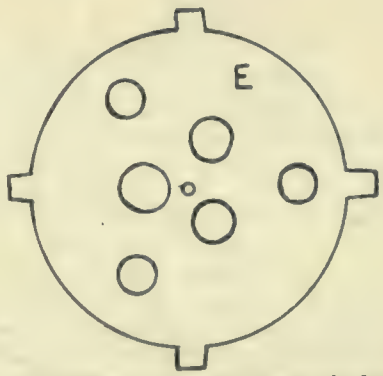




Fig. 5.—Molding air chamber cover in loam.

years, the Canadian Billings & Spencer being an off-shoot of the Billings & Spencer, of Hartford, Conn., one of the oldest concerns of its kind in the United States. Its output is of the nature of automobile parts and fine forgings, while that of the Canada Forge, Ltd., is of a somewhat heavier character, consisting largely of locomotive parts and heavy forgings of various kinds.

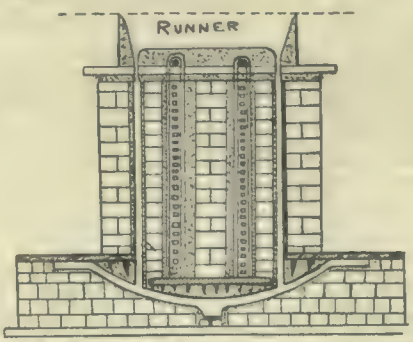



Fig. 6.—Molding air chamber cover in loam.

## PANAMA CANAL LOCK TOWING SYSTEM.

WORK is advancing upon the locomotive tracks at both the Gatun and Pedro Miguel Locks. The tracks are to carry the electric locomotives which control the movement of vessels through the locks. It is necessary that each lock chamber be equipped with a towing track and return upon either side. This requires seven complete tracks at each of the locks—a towing and a return track upon each side wall, and a pair of towing tracks and a common return track upon the centre wall. All tracks extend the entire length of the lock walls and are provided with crossovers at both ends. The lines of the towing locomotives are fastened to the vessel in either the upper or lower forebay, and the locomotive then begins its travel; continuing at the rate of two miles an hour the entire length of the towing tracks. At the end of the run, the locomotive is transferred on the crossovers to the return track, upon which the return trip is made at the rate of five miles an hour.

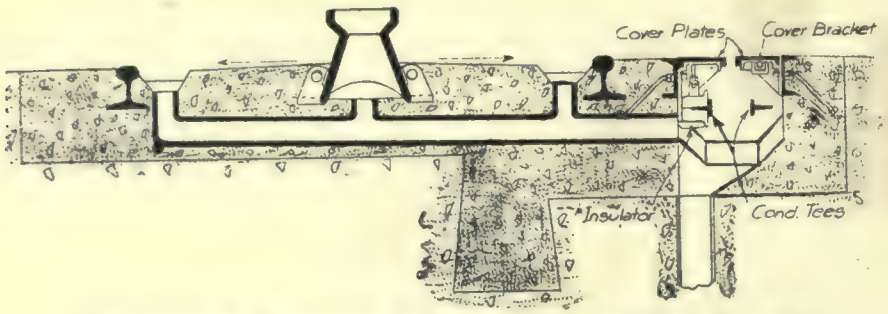



Fig. 2—Panama Canal—Large Scale Section of Towing Track, Showing Details of Rack, Conductor Slot and Drains.

In comparison with ordinary first-class railway construction, the locomotive trackage of the locks is unique. In point of durability, the system has no superior. The foundation is of concrete; the ties are of steel; the rails are heavy-weight—90 pounds to the yard; and, in addition, there is a rack for the towing track, a conductor slot housing a pair of electric rails for both the towing and the return track, and a complete drainage of surface, rack, rail gutters, and slot.

The installation is adapted to the ever varying features of the masonry construction. The towing track, which is subjected to the heavier duty, is in general supported upon the massive concrete adjacent to the edge of the lock chamber, a continuous, wide groove, 12 inches deep, having been left in the initial masonry as space for the erection of the track. The towing track is provided with heavy anchor bolts at each tie, spaced on three-foot centres and imbedded two and one-half feet in the concrete. Such anchoring is essential in order to provide against an up-pull of the thrust wheels on the locomotive acting against the rack, the thrust being possible in case of extraordinary side-pull of the towing lines, tending to overturn the locomotive. The return track is of somewhat lighter construction and, in general, is supported directly above the operating tunnels of the lock walls. The typical tie spacing upon the return track is 3 feet 9 inches, instead of three feet, as for the other. The tracks contain vertical curves between lock levels and horizontal curves at offsets; the former constructed on a 100-foot radius, and the latter on a 200-foot radius. Other special constructions are found at the cantilever decking over the indented recesses for miter gates, at the different crossovers, at the emergency dam inclines, at chain fender rooms, at intake and discharge valve rooms, and at a few manholes and cable shafts.

The accompanying illustration, Fig. 1, shows a typical cross-section of the towing and return track as installed. The towing track is situated 6 feet 9 inches to centre line from the edge of the lock chamber and rests upon the solid masonry of the gravity section of the lock wall. In this masonry, a channel twelve inches deep and a dove-tailed groove are left until the track and anchors have been set, when the concrete is carried up to final elevation, and the track and anchors thoroughly imbedded. The track material is furnished under contract; the ties, rack, and rails being drilled ready for connecting. In the field, the ties are spaced out, the rails spliced and bolted to the ties, as well as one side channel of the conductor slot. The rack is also bolted in position. The entire track is aligned and leveled, and the concrete cast, graded, and finished for proper drainage.

The surface of the concrete is sloped from the rack at the centre of tracks to rail gutters on either side, which gutters are sloped longitudinally to frequent outlets. At every outlet, a special cast-iron drain pipe, two inches in diameter, carries the water from each rail gutter and from underneath the rack to a sump situated at the bottom of the conductor slot on one side of the track. A four-inch drain pipe connects the conductor slot sump to a large drainage tunnel located underneath the duct space of the operating tunnel, fourteen feet below the coping. Other drains have a discharge at the conductor slot sump. This construction is varied to suit different requirements of centre wall return track, as well as other conditions. The finished appearance of the track is very trim, a relatively small portion of the rail being exposed to view and to the action of the elements in a tropical climate.

A rack, Fig. 2, for supplying the requisite traction is placed upon the centre-line of each towing track, as ordinary friction between wheels and rail is not sufficient for the maximum towing pull. The rack is of cast steel and of peculiar section, designed for the double purpose of engaging the driving cog of the locomotive and also a pair of horizontal thrust wheels; the function of which is to prevent overtipping of the locomotive in event of an excessive side-pull of the tow line. The pitch of the rack teeth is 3.13 inches, and each rack section is cast in lengths of six feet; being double tie-spacing. The sections are bolted together longitudinally and also bolted to each tie.

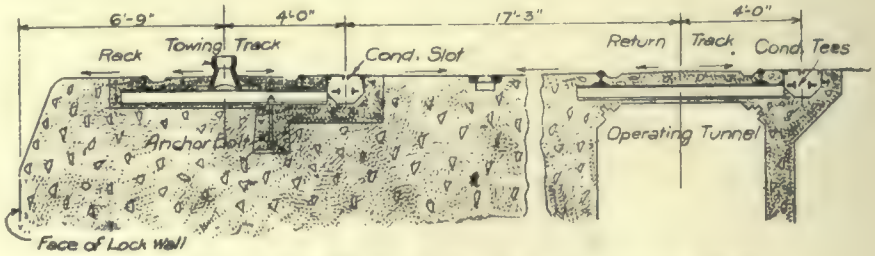



Fig. 1—Panama Canal—Section of Lock Side Wall, Showing General Features of Towing and Return Tracks.

The ties are rolled steel of modified I section, 5½ inches high with a top base of 8 inches and a lower base of 4½ inches. In railway work, it is common practice to install the larger base of the tie on the lower side to obtain a better bearing value. With a rail embedded in the concrete, the bearing value is of smaller importance, and the ties for the towing track are installed

with the larger base up in order to furnish more space for bolting the rack to the ties. A conductor slot is provided on the off-tow side of each track as a means of supplying electrical energy to the locomotive, which operates on a 3-phase circuit at twenty-five cycles and 220 volts. Two of the phases are carried through the conductor slot, whereas the third phase is connected to the two running rails and grounded. The two conductors in the conductor slot are of T-section and supported by clamp insulators from malleable iron brackets. For the towing tracks, the T-conductors are manufactured from copper ingots by the extrusion process, as considerable current-carrying capacity is necessary. For the return track, rolled steel T's are used as conductors. The conductor slot proper is 14 inches wide by 11 to 14 inches deep; the depth varying in order to slope toward the drainage sumps. The upper corners of the conductor slot are protected by five-inch channels imbedded and anchored into the concrete. Rolled steel checkered plates, in sections 30 feet long, cover the slot, resting upon frequently spaced brackets. A pair of contact plows, which bear against the flat side of each conductor rail and are attached to the locomotive, transmit the current from the conductors to the locomotive motors.

## ROLLER AND BALL BEARINGS.

By Prof. John Goodman, M. Inst. C.E.

FOR the past 15 years the author has been investigating the behavior of both roller and ball bearings, in order to find the load and speed at which such bearings may be allowed to run. The object of this communication is to lay before the institution the results of a large number of tests of bearings, together with an attempt to reduce the mass of information obtained to a definite law. Two distinct types of testing machines were used: one for roller and ball bearings running on a cylindrical journal, and the other for thrust and collar bearings. These are described.

### Roller Bearing References.

The common types of roller bearings are then referred to, and their relative advantages and disadvantages are discussed. Emphasis is laid on the serious troubles that arise from the end-thrust on the rollers The reason for the existence of end-thrust is dealt with and proposals are made for minimizing its ill effects. The machines used for measuring the friction of bearings and the end-thrust are described, and the results are tabulated. The tests show that the friction of roller bearings is much lower than that of ordinary bearings as commonly lubricated; the coefficient of friction is also more constant than with a plain bearing, being practically independent of speed and temperature. The starting effort of a roller bearing is little, if any, greater than the running resistance; a very important feature in machines which are constantly stopped and started. No satisfactory expression has been found for the safe load under which a roller bearing may be run. The various frictional losses that occur in a roller bearing have been analysed, and expressions are given for each.

### Ball Bearing References.

Ball bearings are found to possess a great many advantages over rollerbearings; the friction is less, there is no end-thrust, and they occupy a much smaller length of shaft than either plain or roller bearings. Hertz's theory of the compression of perfectly elastic spheres and the stresses which occur in then when loaded is cited, and its application to the ball bearing problem is pointed out.

Very early in the author's experimental investigation it was found that the speed of rotation of the shaft and the balls makes a great difference to the working load that may be imposed on a ball bearing. It is shown that the centrifugal force acting on the balls does not materially increase the load upon them, hence the speed effect is not due to that cause. It is believed to have some relation to the well known effect of very rapid reversals of stress. The effect of running balls on flat and on grooved surfaces is dealt with, the experiments largely corroborating theoretical investigations.

The extreme importance of having all the balls in one race of exactly the same size, also of obtaining perfect truth and freedom from scratches in the ball races, is insisted upon. Expressions based on experimental data are given for the limiting working-load of ball bearings of both the thrust and radial types, and curves are plotted to show how the author's experiments agree with the tables found in makers' catalogues. The question of finding the load which will ultimately bring about failure in a ball bearing is one which presented some difficulty. Bearings which appear to be perfect to the naked eye after running for several months may ultimately fail if allowed to run for years. It is obviously out of the question to run test bearings for this length of time. Other methods, therefore, for detecting impending failure were tried, but without success, until the microscope was used for the examination of the balls. This method proved to be very valuable, and is believed to give entirely satisfactory results. The results of tests of ball bearings of different makes and designs are tabulated in an appendix. The design of bearings is also dealt with.

The author is of the opinion that modern ball bearings, as turned out by the best makers, are entirely satisfactory and reliable, and there is no reason to apprehend trouble with them. Reasonable care, of course, must be taken in mounting the bearings, and in ensuring that they are not allowed to run under higher loads than are given by the author's expressions. Ball bearings are more expensive to purchase than plain bearings fitted with ordinary lubrication, but the friction is about one-tenth as great, and the oil required is almost nil. When these qualities are taken into account, the ball bearing for almost every purpose is considered to be vastly superior to plain bearings. The paper, of which the foregoing is an abstract, together with illustrations of various types of bearing and curves giving the results obtained, was read recently before the Institution of Civil Engineers, London, Eng.

## HEAP & PARTNERS (CANADA) LTD.

Heap & Partners (Canada) Ltd. have opened an office in Montreal to handle the Canadian business of Messrs. William Heap & Co., Liverpool, England, an old established firm who have been entensively engaged in the home and export trade for the last fifty years. Heap & Partners are Canadian agents for David Colville & Sons, Motherwell, Scotland; Samuel Osborn & Co., Sheffield, England, and Thomas Piggott & Co., Birmingham, England, manufacturers respectively of steel plates and bars, tool and implement steel, welded and riveted steel pipe. They will also carry galvanized and black sheets of every description and cater for such requirements as gas engines and producers, high speed steam engines, air compressors, turbine pumps, etc.

Mr. C. E. Gausden is managing director of the Canadian Company, and Mr. A. H. Atkins, A.M.I.M.E., A.M.I.E.E., one of the directors, having charge of the engineering department of the Liverpool office is spending a few months here to help along the introduction of the various specialties. The firm have also on their staff, Mr. E. S. Wilson, Sheffield, England, who, for several years was connected with the manufacture of high-speed tool steels.

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Victoria, B. C.**—The Western Ontario Iron Company has been incorporated with a capital of $50,000. The directors are, M. B. Jackson, Victoria; J. W. Frost, Greenwood, B.C., A. S. Hood, Phoenix, B.C.

**Saskatoon, Sask.**—The following companies have been incorporated,—Northern Planing Mills with a capital of $50,000; The Fawcett Hardware Co., with a capital of $20,000; Saskatoon Construction and Engineering Co., with a capital of $20,000.

**Edmonton, Alta.**—The Van Syke Plow Co., has been incorporated with a capital of $10,000.

**Toronto, Ont.**—The National Iron Works, Ltd., are preparing plans and specifications which, when completed, will double the present capacity of their plant. Mr. Gordon F. Perry, manager of these works, is superintending the details of these plans.

**Porcupine, Ont.**—The building operations on the Pearl Lake Gold Mines shaft-house will soon be completed. It is the largest and the most substantial shaft house in the camp.

**Port Mann, B.C.**—It is understood that a plant for the manufacture of pig iron will be established here.

**Chatham, Ont.**—The Chicago Steel Brake Co., manufacturers of tinsmiths' brakes will move from their present location to a new plant which they purpose building in the spring.

**Sarnia, Ont.**—The H. Mueller Manufacturing Co., who received a bonus of $20,000 from the town, have not yet selected a site for their new industry. An option on the Standard Chain Works property is being obtained. They must invest $100,000 within the limits of the town in the industry of brass manufacture.

**Vancouver, B.C.**—It is understood on good authority that the Jenckes Machinery of Quebec will establish a branch factory here within the year and that they will be prepared to handle a very large business. All kinds of machinery will be manufactured and a large staff of men employed.

**Hespeler, Ont.**—The Hall-Zyrd Co. have removed here from Grimsby. The moulders have been busy for some time and the other departments are now under way.

**Vancouver, B.C.**—The Norton Griffiths Steel Construction Co. propose building repair yards here to look after their derricks, machinery, wagons, etc.

**Neepawa, Man.**—T. R. Deacon, manager of the Manitoba Bridge & Iron Works, was in Winnipeg recently, looking over the proposed site should the company decide to locate here.

**New Westminster, B. C.**—Messrs. Ackerman and Blakely have disposed of their patent rights on their draught excluders to the B. C. Brass Works on a royalty basis.

**Port Colborne, Ont.**—The Canadian Union Furnace Co. will erect a $500,000 plant here including a blast furnace and dock. Their product will be foundry and malleable iron, bessemer and basic pig, finished steel, etc. The concern will employ about 150 men, and is the Canadian plant of the Buffalo Union Furnace Co.

**Stratford, Ont.**—The ratepayers will vote on a by-law to guarantee the bonds of G. L. Griffiths of Melbourne, for $5,000, to open a factory for the manufacture of harness and hardware.

**Port C lborne, Ont.**—The ratepayers carried the two by-laws to the G. T. R. and the Canadian Union Furnace Co.

**Niagara Falls, Ont.**—The ratepayers will be asked to approve of an appropriation of $3,000 for a factory site.

**Moose Jaw, Sask.**—A prominent Canadian Sheet Steel manufacturing concern will build a large factory here in the near future.

**Drummondville, Que.**—The town has awarded the contract for its new power house. The Bishop Construction Co., Ltd., Montreal, who will construct the building, have sublet the following contracts,—(1) To the Wm. Hamilton Co., Peterborough for a 250 h.p. water wheel. (2) To the Allis-Chalmers-Bullock Co., Ltd. Rockfield, Que., for a 150 k.w. generator.

**Saskatoon, Sask.**—The Western Foundry and Machine Company are preparing to manufacture sewer pipes. They will erect a new warehouse and have purchased the right for Saskatchewan for the manufacture and sale of the Thomas glazed cement sewer pipe and have engaged an expert sewer pipe maker as foreman of the new department. The company are making the manhole covers used in connection with this city's sewer system. Mr. A. E. Small is general manager of this company.

**Montreal, P. Q.**—A report states that a new car construction company are considering the erection of plant in this city. No particulars or names are mentioned in the report.

**Calgary, Alta.**—It is reported that the Pioneer Tractor Company will erect a plant in this city. Dr. Wheelock, of Winona, Wisconsin, is interested in the matter.

### MUNICIPAL.

**Chatham, Ont.**—On April 8th, the ratepayers will vote on a by-law granting certain concessions to the Canadian St. Mary's Machine Co.

**Fort Colborne, Ont.**—The ratepayers contemplate granting certain concessions to the Canadian Furnace Company who propose to expend $1,000,000 on an iron and steel plant.

**Vancouver, B.C.**—The Dietrich Saw Works of Galt, Ont., will establish a branch in Vancouver.

**Swift Current, Sask.**—A six stall engine house and express building will be constructed by J. McDiarmid of Winnipeg.

**Wetaskiwin, Alta.**—The municipality contemplates expending $16,000 for waterworks and sewers.

**Sandwich, Ont.**—The council passed by-laws authorizing an issue of $4,952.82 for the Bedford St. sewer, and another for $9,385.25 for the Askin Ave. sewer.

**North Toronto, Ont.**—The council will submit a by-law to raise $60,000 for building a pumping station.

**Moose Jaw, Sask.**—The council contemplates expending $60,000 to install a high pressure water system.

**St. Catharines, Ont.**—The ratepayers will vote on a proposal to buy out the plant of the St. Catharines Gas Co. for $38,000.

**Claresholm, Alta.**—A by-law has been carried to spend $8,000 for waterworks purposes.

**Port Stanley, Ont.**—A by-law to expend $22,000 for waterworks purposes has been carried.

**Kindersley, Sask.**—The burgesses passed the by-law to provide $50,000 for waterworks purposes.

**Richmond, Eburne, B.C.**—The municipality proposes to expend $50,000 for a waterworks system.

**Oak Bay, B.C.**—The ratepayers will vote on by-law to raise $275,000 for sewer purposes and $75,000 for a waterworks system.

**Moose Jaw, Sask.**—The ratepayers will vote on a by-law to provide $170,000 for waterworks and sewer extensions.

**Fort Frances, Ont.**—The municipality propose expending $25,000 for sewage and waterworks.

**Neepawa, Man.**—The municipality contemplate expending $100,000 for extension of waterworks and sewage system.

**Kindersley, Sask.**—The municipality will expend $50,000 upon a waterworks installation.

**Saskatoon, Sask.**—The successful bidders for the supply of waterworks materials for Saskatoon, are as follows:—

For cast-iron pipe, the Canada Iron Corporation, $72,200.00; for valves and hydrants, Messrs. Drummond, McColl, $10,700.00; for corporation brass, the H. Mueller Mfg. Co., $3,000.00; for lead and iron pipe and service boxes, Messrs. Jas. Robertson Co., $8,500.00.

**Niagara Falls, Ont.**—The city is negotiating with the Provincial Government re the erection of a new power house and pumping station. The amount of power they intend to develop is about 4,000 h.p.

**Sudbury, Ont.**—The city calls for tenders for the following works:—(1) main sewer, 8,555 feet. 20 in., 18 in., and 15 in. (2) Sanitary sewers and force mains. (3) Sewer pipes and junctions.

**London, Ont.**—The council has applied to the legislature for permission to issue debentures, for additions to pumping plant apparatus and main extensions, to the extent of $61,000.

**Hamilton, Ont.**—The city will receive tenders for brass work for waterworks purposes, and other hardware, to be used in this connection.

**Calgary, Alta.**—The Commissioners recommend the submitting of by-law to provide $50,000 for sewer extensions.

**Toronto Ont.**—The municipal council intend to install the following water works material:—Two 36-inch mains under tracks, main pumping station to Front Street, $44,459; 42-inch main along Front Street to Bathurst Street, $55,048; 24-inch main along Niagara Street to Queen Street, $33,535; 36-inch main cross town line, Beverley Street to Sumach Street, $148,477; Two 15,000,000-gallon triple-expansion engines, including buildings and connections, $350,000. The existing debenture debt of the city (not including the Local Improvement Debt) is as follows:—General Debenture Debt, $26,415,642.30; Water works debt, $9,120,321.22; Debt for electric power distribution plant, $4,950,000=$14,070,321.22.

**Guelph, Ont.**—The Water Commissioners have awarded the following contracts for the supply of water works material: Galvanized iron pipe, the Bond Hardware Co.; brass goods, Miller, Limited, London; valves, Kerr Engine Co., Brantford; cast-iron pipe and specials, Gartshore-Thompson, Hamilton; valve boxes, Kerr Engine Co., Walkerville.

**Toronto, Ont.**—The Board of Control in dealing with the waterworks estimates did not strike out the item of $250,000 for two fifteen million gallon pumps connected to triple expansion engines and buildings, but decided that they should not come out of this year's taxes. A by-law to raise the amount will probably be submitted to the ratepayers in June.

**Vancouver, B.C.**—Tenders have been received for the trunk sewer and construction of laterals. The amounts varied between $120,055 and $89,071.

**Hamilton, Ont.**—The city is calling for tenders for a new waterworks intake pipe and for a steel conduit from the Beach Pumping station to the filtering basins.

**Castor, Alta.**—The ratepayers propose expending $40,000 for a waterworks system.

**Stratford, Ont.**—The ratepayers will vote on a by-law to guarantee the bonds of G. L. Griffiths of Melbourne for $5,000, to open a factory for the manufacture of harness and hardware.

**Watrous, Sask.**—The ratepayers passed the by-law providing for the waterworks system.

**Port Stanley, Ont.**—The ratepayers passed the by-law to provide $22,000 for a waterworks system.

**Verdun, Que.**—The town council carried the by-law to provide $229,000 for various improvements including waterworks and electric light extensions.

**Digby, N. S.**—The town will expend $15,000 on an electric lighting system.

**Bassano, Alta.**—Several by-laws regarding expenditures of approximately $200,000 are contemplated. One of the proposals is for waterworks and sewer extensions.

**Scott, Sask.**—The town will make extensive improvements on its waterworks system.

### ELECTRICAL.

**Wetaskiwin, Alta.**—The municipality proposes expending $23,000 for electric lighting purposes.

**Brampton, Ont.**—Notice has been given for the introduction of a by-law to raise $12,000 by way of a temporary loan for Hydro-Electric purposes.

**Medicine Hat, Alta.**—A by-law will be introduced providing for the construction of a municipal street railway.

**Moose Jaw, Sask.**—The ratepayers will vote on a by-law to provide $225,000 for electric light extensions.

**Dundas, Ont.**—The Cataract Power Co., Hamilton, will erect a new sub-station here and remodel the lighting plant.

**Toronto, Ont.**—Fire destroyed the King Street car barns of the Toronto Railway Company, on March 25th last. The damage is estimated at $300,000.

**Winnipeg, Man.**—A report from this city states that the Winnipeg Electric Company has been sold and is now under the control of United States capital. The Manitoba Power Company are the purchasers and the report further mentions that the sub-companies are included in the sale. A complete appraisement of the value of the Winnipeg Electric Company is now being made by Messrs. Foster and Richardson of J. G. White & Co., of New York. A further staff is at work on plans of proposed extensions and developments, including that of the Big Bonnet Falls on Winnipeg River which will be carried out after re-organization at an estimated cost of $14,000,000. Rudolph E. F. Flinsch, treasurer of Messrs. White & Co., is in charge of the financial department of the work, representing New York bankers whose names will appear later. Joseph R. Choate, Jr., of New York, and W. R. Mulock, of Winnipeg, are attend-

ing to legal details. The price of the purchase is not made public, but is considered to be a large sum above $24,000,000.

**Galt, Ont.**—The Hydro-Electric Department will present plans to ran ornamental street lighting system to the city council at an early date.

**Verdun, Que.**—The town council carried the by-law to provide $229,000 for various improvements including waterworks and electric light extensions.

**Digby, N. S.**—The town will expend $15,000 on an electric lighting system.

**London, Ont.**—The London & Lake Erie Transportation Company has signed a contract with the Hydro-Electric Commission for five hundred or more horse-power, at $28 per horse-power, $10,000 will be spent on new cars and other equipment.

**Wilmer, B. C.**—The Firlands Irrigation and Power Company, Limited, has been incorporated with a capital of $10,000, to operate and construct telephone and telegraph systems, tramways, etc., and to conserve water powers for the development of electricity, light or other powers, the head office is at Wilmer, B.C.

**Coaticook, Que.**—The town will install shortly a 250 k.v.a. generator. Tenders are invited.

**Ottawa, Ont.**—Plans have been filed here at the Carleton Co. Registry office in connection with the expropriation of the Chats Falls by the Hydro-Electric Power Commission of Ontario.

**Sydney, C. B.**—The Arena Rink Co., has been incorporated with a capital of $50,000. A modern rink will be erected at once. It will have its own up-to-date electric lighting plant and power house.

**Davidson, Sask.**—A new 62 h.p. gas-producer plant is about to be installed in the electric light plant to replace the old 36 h.p. plant.

**Galt, Ont.**—The Plumbers here are protesting against the action of the Hydro-Electric Dep. retailing incandescent lamps at an advance of 10 per cent. over cost.

**St. Catharines.**—The Crocker Wheeler Co., contemplate making a $60,000 addition to their plant here.

**Port Arthur, Ont.**—The municipality recently voted $75,800 for street railway improvements and $6,000 for an electric pump.

**Niagara Falls, Ont.**—Edson Pollard, representing an American Syndicate, offers to purchase the electric light plant for $6,000. A by-law will be submitted to the ratepayers shortly, re the proposition.

**Innisfail, Alta.**—The municipality propose to expend $15,000 for electric lighting purposes.

**Verdun, B.C.**—The council proposes to raise a loan of $229,000 of which $129,000 will be spent on the extension of the electric light plant, the increase of the water supply and the betterment of the fire-protection.

**GENERAL MANUFACTURING.**

**Medicine Hat, Alta.**—The Ogilvie Flour Mills will erect here a 9,000 barrel flour mill, oat meal mill, and cereal plant, the cost of which will be about $500,000. The city gives the company a free site and natural gas for ten years.

**Toronto, Ont.**—Prices Limited have been incorporated with a capital of $100,000, to manufacture and deal in bricks, tiles, pipes, artificial stone for building, paving and other purposes. The head office is at Toronto, and the provisional directors are David Henderson, W. H. McGuire and C. F. Rooney, all of Toronto.

**Rosthern, Sask.**—The Union Supply Co., Limited, will rebuild the flour mill destroyed by fire in December, cost about $20,000.

**Stratford, Ont.**—On April 19th next, the ratepayers will be asked to vote on a by-law to guarantee $8,000.00 worth of bonds for a knitting plant.

**Toronto, Ont.**—The premises of R. A. Sabbiston Company, horse blanket manufacturers, was damaged by fire to the extent of $100,000.

**Toronto, Ont.**—The Gendron Manufacturing Company and the A. B. McColl building were damaged to the extent of $10,000 to the former and $25,000 to the latter.

**Toronto, Ont.**—The plant of the Marshall Sanitary Mattress Company was damaged by fire to the extent of $8,000 recently.

**Weyburn, Sask.**—The elevator of the Western Elevator Company was destroyed by fire on March 19th last.

**Wainwright, Alta.**—The municipality proposes to grant a loan of $10,000 to assist a milling concern to locate here.

**Moose Jaw, Sask.**—The Robin Hood Flour Mills will be rebuilt with double their original capacity.

**Moose Jaw, Sask.**—A new 4,000 barrel flour mill will be erected here immediately. The mill will be in operation by the autumn.

**Lindsay, Ont.**—The Hood Knitting Company suffered a heavy loss by fire on March 28th.

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**A Machine Shop Necessity.**

**Our Line**
**12", 16", 20", 24" Machines**

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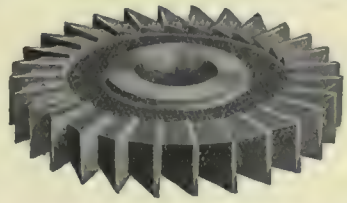

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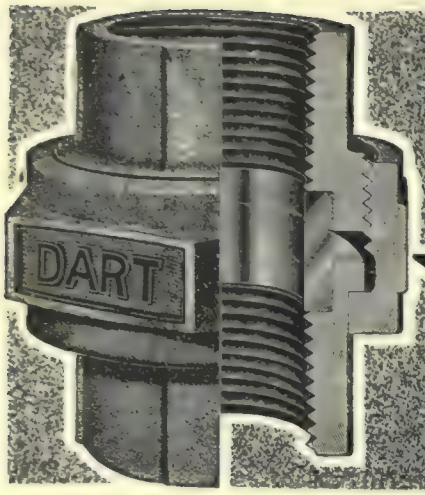


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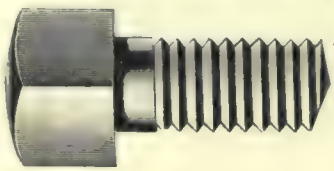

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THE J.C. McLAREN BELTING CO. OAK EXTRA TANNED EST 1856

TORONTO ST JOHN N.B MONTREAL WINNIPEG VANCOUVER

**St. Catharines, Ont.**—The Dominion Canners purpose erecting a factory in the Fonthill district and expect to have it completed for this season's work.

**Fort Frances, Ont.**—A big preserving plant is now in operation here, treating ties for railways. The present capacity is 1,500 ties per day, but will be increased three-fold during the coming season.

**Saskatoon, Sask.**—It is expected that a flour mill of 2,000 bbls. per day capacity will be erected here shortly.

**Vancouver, B.C.**—It is understood that the Dominion Bed Mfg. Co., of Kent, Wash., will shortly establish a factory here of 250 beds per day capacity.

**Seaforth, Ont.**—The Canada Furniture Co. have agreed to enlarge their factory and employ in the neighborhood of 60 additional hands if the town will provide a site.

**Durham, Ont.**—The Durham Furniture Co. have nearly completed the new addition to their factory and will employ 100 additional workmen in the near future.

**St. John, N.B.**—A piano factory will be established here this spring. Building operations will commence shortly.

**Guelph, Ont.**—C. J. Furber & Co., of Elmira, have decided to move their weather strip factory to Guelph and manufacture some additional lines.

**Thorold, Ont.**—The ratepayers granted a fixed assessment to a company of local capitalists for a large Pulp and Wood mill on lock 23 of the Welland Canal. The Company is capitalized at $1,000,000.

**Courtright, Ont.**—On Apr. 5th the ratepayers will vote on a by-law providing for a loan of $1,500 to the Western Construction Co.

**Aurora, Ont.**—The ratepayers passed the by-law to grant a bonus of $10,000 to the Collis Leather Co.

**Smith's Falls, Ont.**—The ratepayers will vote on a by-law to grant a loan of $25,000 to the Perth Shoe Co.

**Ingersoll, Ont.**—The ratepayers will vote on a by-law to grant a loan of $10,000 to the Ingersoll Motor Co.

**Listowell, Ont.**—The town contemplate offering some inducements to a biscuit factory to locate here.

**Melville, Sask.**—On Apr. 6 the ratepayers will vote on a by-law to grant $6,000 to start up a mill.

**Lander, B.C.**—The McLellan Lumber Co., are erecting a large lumber mill here and have applied to the Delta municipal for exemption from taxation and free water for a period.

**Medicine Hat, Alta.**—Work on the Preston Planing Mills will be started at once. When completed they will employ about seventy-five men.

**Tide, N.B.**—The Hardwood Planing Mills have been incorporated with a capital of $150,000.

**Moose Jaw, Sask.**—The Western Manufacturing Co., purpose erecting here the largest woodworking factory in the Prairie Provinces. They will employ upwards of 100 men all year.

**Coquitlam, B. C.**—The Canadian United Lumber Company have prepared plans for the erection of a new mill in this town. The Western Canada Power Company will supply the power to operate the machinery.

**North Bay, Ont.**—The planing mill of Jas. A. Cole & Co. was almost entirely destroyed by fire.

**Orillia, Ont.**—The planing mill of J. R. Eaton & Sons was almost totally destroyed by fire on Mar. 27th.

**Vancouver, B.C.**—The A. E. Olts Company, has been incorporated with a capital of $100,000, to carry on business as builders, dealers in timber, cement, and other supplies with head office at Vancouver, B.C.

**Victoria, B. C.**—Canadian Southern Lumber Company, Limited, has been incorporated, with a capital of $200,000, to carry on business as sawmill owners, lumber merchants and manufacturers of timber products, etc., with head office at Victoria, B.C.

**Vancouver, B. C.**—The English Bay Lumber Company, Limited, has been incorporated with a capital of $30,000, to carry on business as saw and shingle mill proprietors, pulp and paper manufacturers and general lumber and timber merchants, the head office is at Vancouver, B.C.

**Nelson, B. C.**—The mills of the Yale Columbia Lumber Company were destroyed by fire. The origin is supposed to be incendiary.

### BUILDING NOTES.

**Edmonton, Alta.**—A new theatre and office building will be erected on the southwest corner of Second street and Jasper Ave. The building will be ten storeys and the bottom floor will be used for shops. It is understood that Geo. Brown & Co. of this city have secured a ninety-nine year lease on the property.

**Fort William, Ont.**—An addition will be built to elevator "D" which will increase its capacity from two and a quarter million

THE Manager of the Largest Works in Canada must at times feel the need of an inexpensive lathe for his private experimental work.

Much good thought and invention die out for want of easily and cheaply making experiments or models of an idea; a whole workshop of expensive tools usually being required, although the model needed may be small.

We have designed a tool for this work. A complete self-acting, sliding, boring and screw-cutting lathe, 4 in. centres, 2 ft. 4 in. bed, capable of doing all plain milling, keyway cutting, etc.

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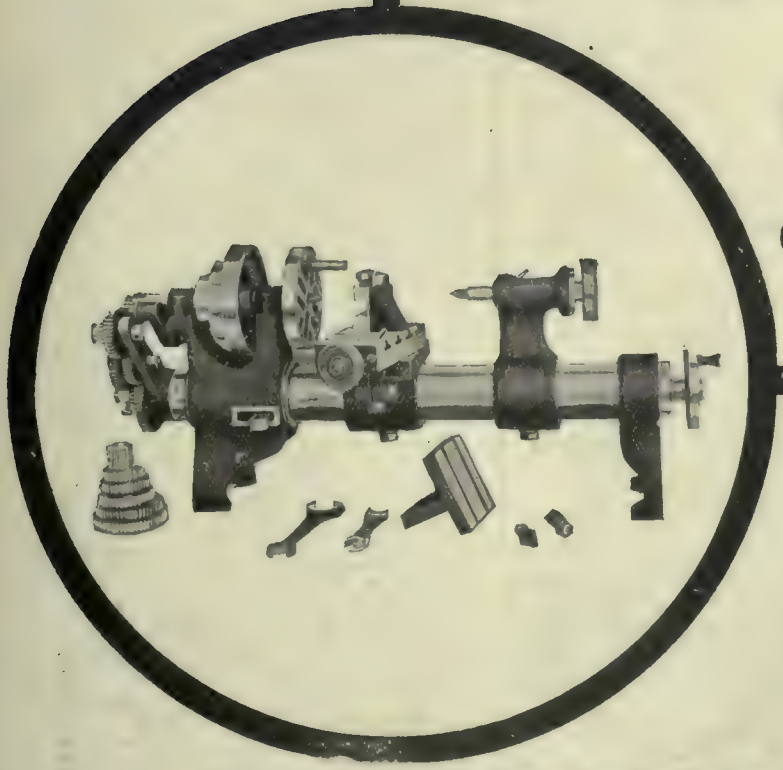

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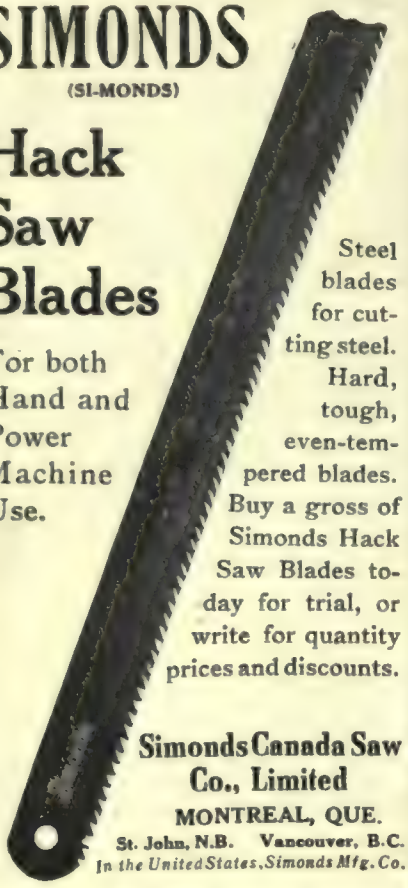

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bushels to nearly three and seven-eighths million bushels. The cost will be about $400,000. Barnet and McQueen are the engineers and contractors. They will employ about 250 men. Work will be rushed to completion to enable the fall grain to be handled.

**Vancouver, B.C.**—Plans are being prepared for a theatre to cost $750.000 for the Vancouver Opera House.

**Saskatoon, Sask.**—The Y. M. C. A. have awarded the contract for the superstructure of their new building to Fred Lewis Co., Ltd., of Winnipeg at $69,300.

**Edmonton, Alta.**—A six storey building will be erected by the C. P. R. on the site of their present offices on Jasper Ave. The building will cost $300,000.

**Toronto, Ont.**—A fourteen storey building will be erected on lots 9-13 King St. W., by Dinnock Bros.

**New Westminster, B.C.**—The municipality is contemplating spending $100,000 to erect a three storey brick and terra cotta high school building, with concrete foundation. The building will be electric lighted, heated by fan system, slate roof, fir interior finish.

**New Westminster, B. C.**—Tenders have been called for to erect a theatre and office building costing $150,000, by the People's Trust Co. The building is to be eight stories, 64 feet x 32 feet, reinforced concrete and steel, electric lighted, seating capacity of theatre 1,450.

**Woodstock, Ont.**—The ratepayers will vote on a by-law April 15 to raise $75,000 for a new city hall.

**Ottawa, Ont.**—The government have purchased lots No. 21-31 Sparks St. for $257,000. A post office will be erected here, the equal of any in Canada.

**St. John, N.B.**—The C. P. R. will build a large elevator here.

**Toronto, Ont.**—Tenders are open for warehouse, cost $60,000, Wellington street west, for Copp, Clark Company, 64 Front street west. Architect, Wickson & Gregg, 59 Yonge street, Toronto. Four storeys, brick, concrete, foundation, steam heating, fire-doors, fire-brick, structural steel, cut stone lintels, tile coping, oak hardwood finish, reinforced concrete, steel rolling doors, boiler house, metal sash and lath, plate and art glass, ornamental iron, plunger and electric elevator, garage, Ohio cut stone. 177h.p. Multitubular boiler, 60-in. diameter and 16 feet long, with 83 3-in. tubes, oxide paint, fireproof paint, tar and gravel roofing.

**Regina, Sask.**—The Saskatchewan Motor Company have had plans prepared by Architect Van Egmond, Regina, for the erection of a garage, four storeys, 54 feet, corner Rose street and Victoria avenue. part of building fitted up for offices.

**London, Ont.**—The Hydro-Electric Commissioners will erect a storage building and patrol house in this city. The building will be erected on Horton Street, adjacent to the city's pumping station, and will be large enough to accommodate the water board's workshop. It is to be erected for the board of water commissioners.

**Calgary, Alta.**—The Calgary Herald intend to erect a ten-storey building on the corner of Seventh Avenue and First Street West. It will be of concrete and steel construction.

**Edmonton, Alta.**—Negotiations have been opened between the municipal authorities and Mr. J. S. Brody as to what location may be secured for the construction of a mattress factory.

**Saskatoon, Sask.**—A new warehouse is being rushed to completion here, by the agent of the Rambler Automobile Co.

**Galt, Ont.**—The Victoria Wheel Works will start operations at once on their new plant at River View Park. They expect to occupy them about July 1st and turn over their present premises to the C. P. R.

## TRADE NOTES.

**The Canadian Union Electric Co.**, capitalized at $45,000, and with head office at 9 St. Nicholas Street, Montreal, have been incorporated recently. They are connected with the Union Electric Co., of England, who are well known as the manufacturers of the Excello Flame Arc Lamp. The firm are specialists on lighting systems, including Electric Shadowless Lighting, sometimes called the Day Light System. They are also specialists on high tension switch gear, and manufacture motors and dynamos. The success which they have had in the Australian market has led them to open up a branch in Canada. They will carry a stock of arc lamps, switch gear, and motors of all sizes. Mr. Allan B. Wearing is managing director of the new company.

**Williams & Wilson**, 320 St. James Street, Montreal, have just published a catalogue of machinery and machinery supplies. It is a most complete and comprehensive collection, containing over 1,300 pages, and illustrated throughout with high quality engravings. The volume is bound in leather. The lines taken up will appeal to such establishments as steam railroads, electric railroads, marine shops, contractors, bridge builders, factories, machine shops, saw mills, paper and pulp mills, flour mills, textile mills, elevators and conveyors, electric light plants, waterworks, mines, etc., etc. The catalogue is available to prospective customers.

**The Brown, Boggs Co., Ltd., of Hamilton, Ont.,** is contemplating an extensive enlargement of its plant, and for that purpose is negotiating for the purchase of six acres of land in the eastern part of the city, on the line of the G. T. R., and T. H. & B. Railways. The company is at present located at the corner of King William Street and Victoria Avenue, and if present plans go through will move from that section of the city as soon as the east end plant is erected. The capital of the concern will be increased to $500,000, and it is the intention to install an up-to-date plant and pay more attention to the manufacturing of tools and machinery.

**The Robb Engineering Co., Amherst, N.S.,** are to instal a 150 H.P. Robb-Armstrong engine, together with boilers, smoke stacks, etc., for the Mountain Park Coal Co., who are located west of Edmonton, Alta.

**Mr. E. Schofield** has recently opened up an office in Montreal and will devote his attention to a number of Canadian agencies. Among the firms he will represent are the Canadian Tap & Die Co., The Galt Machine Screw Co., The London Foundry Co., The London Bolt & Hinge Works, the P. L. Robertson Mfg. Co., and others. For the past eight years Mr. Schofield has been acting in the capacity of Salesman for Alexander Gibb, manufacturers' agent, Montreal. Previous to this he was connected with B. J. Coghlin & Co., and Jas. W. Pyke & Co. Prior to coming to Canada from Manchester in 1900, Mr. Schofield served an apprenticeship to the engineering trade, and is thus competent to demonstrate, when necessary, the use of the various tools he is selling.

**The Smart-Turner Machine Co., Hamilton,** report the following orders recently received: The Point Anne Quarries, Toronto, centrifugal pump; the New Brunswick Pulp & Paper Co., Millerton, N.B., independent jet condenser; Grenville Board & Pulp Co., Thorold, centrifugal pump; Messrs. Cushing Bros., Saskatoon, Sask., duplex pump; the Jonquiere Pulp Co., Jonquiere, P.Q., duplex pot valve pump; the Big River Lumber Co., Big River, Sask., centrifugal pump; the Bird Woolen Mill Co., Ltd., Bracebridge, Ont., single acting triplex power pump; the Annette school, West Toronto, feed pump and receiver; the Dryden Timber & Power Co., Dryden, Ont., centrifugal pump; the Brown school and Manning Avenue school, Toronto, pumps and receivers; the Toronto Furniture Co., Toronto, simplex vacuum pump; the Steamer "Shuniah," duplex pot valve pump; the Intercolonial Railway, Stellarton, N.S., duplex pot valve pump.

**The Hade, Davock & Beltaire Co.** have recently been organized, with headquarters in Toronto, to devote special attention to the reorganization and systematizing of manufacturing concerns. The company is now engaged upon important work of this kind and have an organization well equipped in all branches of modern manufacturing and merchandising to take up the problems of scientific management, organization and sales.

**The Joseph Dixon Crucible Company of Jersey City,** has put on market a new chain graphite, especially intended for lubricating the chains of motor trucks and pleasure cars. This preparation is put up in sticks, cylindrical shape, 2 inches x 8 inches, encased in a neat cardboard carton and weighing about one pound each. It is made of the same material as the Dixon Bicycle Stick Graphite with which every bicycle owner is familiar. A bar may be carried on the car ready for use at any time. To apply, it is simply necessary to run the bar against the sprocket side of the chain. The "big stick" makes it easy to keep automobile driving chains in first-class condition. Unlike oils and greases, it will not collect dust and dirt.

**Winnipeg**—Messrs. Seimens Bros. Dynamo Works have been awarded the contract to supply the transformers and switchboards for the city. This firm will install the above previous to June 30th, 1912.

**Ridgetown.**—F. W. Farncomb, C. E., of London, Ont., acting for the Town of Ridgetown, has awarded the contract for the installation of the pumping equipment to the Canadian Fairbanks-Morse Co., of Toronto, for the sum of $7,500. The equipment will consist of one Fairbanks-Morse 60 h.p. natural gas engine, one Fairbanks-Morse 40 h.p. gasoline engine, two Smart-Turner double-acting triplex power pumps and three Goulds deep well pumps. The installation to be complete June 1st, 1912. The contract for the power house and pump well has been awarded to Geo. Poag, of Ridgetown, Ont.

**Hamilton**—The Gartshore Thomson Co. are about to erect an addition to their plant. This has become necessary owing to the large contract recently secured from the municipality for cast iron pipe.

**Fort William**—Tenders for 18-in. cast iron water mains will shortly be received by city engineer. Cost $45,000.


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19th Edition.

The Complete Practical Machinist: Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, The Making and Use of Tools, Tool Grinding, Marking Out Work, Machine Tools, etc. By Joshua Rose, M. E. Illustrated by 395 engravings, 19th edition, greatly enlarged, with new and valuable matter. 12 mo., 504 pages. Price, $2.50. BY MAIL, FREE OF POSTAGE, TO ANY ADDRESS IN THE WORLD, AND FREE OF DUTY IN CANADA.

Abstract of Contents—Chapter I.—Cutting Tools for Lathes and Planing Machines. II.—Cutting Speed and Feed. III.—Boring Tools for Lathe Work. IV.—Screw Cutting Tools. V.—Lathe Dogs, Carriers or Drivers. VI.—Turning Eccentrics. VII.—Hand Turning. VIII.—Drilling in the Lathe. IX.—Boring Bars. X.—Slotting Machine Tools. XI.—Twist Drills. XII.—Tool Steel. XIII.—Taps and Dies. XIV.—Vise Work; Tools. XV.—Fitting Connecting Rods XVI.—Milling Machines and Milling Tools. XVII.—Grindstone and Tool Grinding. XVIII.—Lining or Marking Out Work. XIX.—Machine Tools. XX.—To Calculate the Speed of Wheels, Pulleys, etc. XXI.—How to Set a Slide Valve. XXII.—Pumps. Index.

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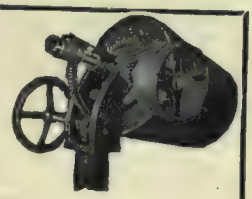

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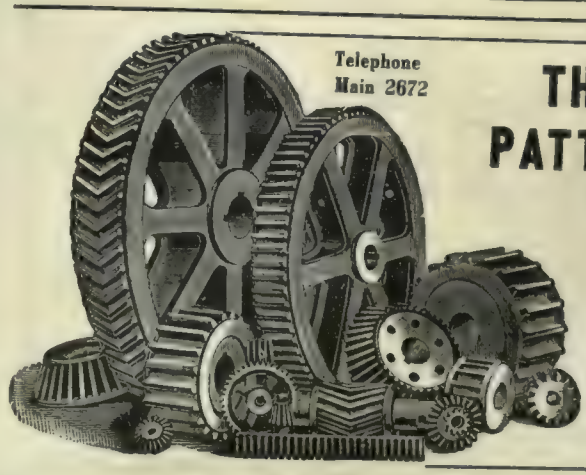

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**The Foss & Hill Machinery Co.**, Montreal, are moving May 1st. to their new show rooms at 344 St. James St.

**The St. Lawrence Welding Co., Ltd.**, has been incorporated with a capital of $50,000. The office and shop are at 13 Roy Lane, Montreal. Edwin C. Richardson is secretary and general manager. The firm will do a contracting business in welding and cutting of all kinds.

**The Dominion Oxygen Welding & Cutting Co.**, with head office and shops at 21 Queen St., Montreal, has just been formed. Company will undertake welding and cutting contracts of all kinds, using the oxy-acetylene process, and will specialize in marine work, boiler repairing and fixing broken machine parts. Several expert operators have been engaged. Mr. L. Vigoureux, late with R. J. Levy and the Blaugas Co., of Canada will be general manager, while Mr. A. M. Barry, late of the Foundation Co., Limited, is connected with the sales staff.

**The George B. Meadows Co., Toronto**, have presently on hand, in different stages of completion, contracts for metal lockers, steel shelving, stair and general ornamental ironwork equipment for the Toronto Furniture Co. new building; the Pathological Building, new General Hospital, Toronto; Toronto Hunt Club; Trinity Boys' School, Port Hope; New Parliament Building; Provincial Museum; Central Prison, Guelph; etc.

## CATALOGUES.

**The Simonds Canada Saw Co., Montreal, Que.**, have forwarded us a pamphlet giving a concise description of the saws, files and hacksaws which they manufacture. The great care in the selection and manufacture of the steel they use in their blades is emphasized. The cuts are excellent.

**The Oeking Co., New York and Duesseldorf, Germany**, have issued their catalogue No. AK 1912. It describes the firm's punching and shearing machinery, all of which are made with cast steel frames. Shears are made for plates, bars, angles and all structural shapes, and details of construction are fully illustrated and described in the catalogue. The firm's managers for the U. S., Canada and Cuba are the Weiner Machinery Co., 50 Church Street, New York.

**Cling-Surface Co., Buffalo, N.Y.**, have issued Bulletin No. 321, a neat folder showing eleven noteworthy installations in Pennsylvania where Cling-Surface is profitably used on belts. Each illustration is accompanied by data concerning the belts shown.

**SKF Single and Double Thrust Ball Bearings** are described in a 16 page bulletin issued by the SKF Ball Bearing Co., 50 Church Street, New York. This bulletin is filled with sound arguments and good illustrations advocating their self-aligning double thrust bearing and their single thrust bearings with or without self-aligning seat. Self-alignment is featured throughout. A bulletin well worth sending for.

**The Wheeler Condenser & Engineering Co.**, Cartaret, N. J., have just issued an attractive 16 page Catalog describing their various lines of condensing apparatus. In a preface entitled "Condenser Engineering" it is pointed out that each equipment is a problem in itself, and that it is necessary that there be a wide range of designs of Condensers, Cooling Towers, Pumps, etc., in order to provide combinations of these pieces of apparatus which will meet the requirements of load, vacuum, water, temperature, supply of water, etc., at the highest efficiency and least operating cost. The Wheeler Admiralty Surface Condenser, The Wheeler Volz Combined Condenser and Feed Water Heater and the Wheeler Admiralty Surface Condenser, Cylindrical Shell Type, are first described followed by a brief description of the Wheeler Dry Tube Surface Condenser and the Wheeler Rectangular Jet Condenser for high vacuum work. Subsequent pages are devoted to the Wheeler Barometric Jet Condensers, the Wheeler-Edwards air pump, Wheeler Rotative Dry Vacuum Air Pump and Wheeler Centrifugal Pumps. Two types of Cooling Towers, viz.: the Wheeler-Barnard for forced draft and the Wheeler-Balcks for natural draft are considered separately and are followed by a description of Wheeler Feed Water Heaters and Wheeler Atmospheric Exhaust Relief Valves. Copies of this Condensed Catalog may be obtained upon application to the Wheeler Condenser & Engineering Company, Cartaret, N.J.

**The Detroit Lubricator Co.** have put on the market an improved type of their standard sight feed lubricator, intended for use on steam shovels, dredges, logging engines, steam hammers and in other situations where there is great vibration. The improvement consists in a lug cast on the body near the bottom. This sits on, and is bolted to, a light bracket clamped to the main steam pipe, thus relieving the oil delivery pipe of all weight or strain and eliminating any possibility of damage to the lubricator from excessive vibration and jarring.

**Mansfield & Sons, Ltd., Birkenhead, Eng.,** have forwarded their catalogue of oil gas apparatus for laboratories. This apparatus is intended for the use of scientists, whose laboratories are isolated from a supply of city gas, and this firm has supplied numbers of them to all parts of the world, one of the most recent installations being at the University of Alberta, Strathcona. The gas is made from mineral, animal or vegetable oil, and has a much higher heat value than coal gas. The plants are made suitable for bacteriological work and for ordinary chemical, physical and agricultural laboratories where a low constant temperature is required, and also for geological and metallurgical laboratories where temperatures as high as 1,500 deg. C are needed.

**The Alberger Pump Co., New York,** have issued a new catalogue of their centrifugal pumps and steam turbines. Their design and construction are fully dealt with and a section of the book is devoted to a review of the development and theory of the centrifugal pump.

**The New Departure Mfg. Co., Bristol, Conn.,** have issued a well-got up catalogue and price list of all types of ball bearings manufactured by them. Numerous illustrations are given showing the various application of these bearings, and the methods employed in measuring and testing them before shipment, are also described in an interesting manner.

**A. B. Jardine & Co., Hespeler, Ont.,** have favored us with a copy of their No. 14 catalogue and also folders descriptive of their forge blower and Canadian giant power hammer. The catalogue deals with the firm's well-know lines of machinists' taps, bolt threading machines, and tube expanders; also with tire benders and upsetters and other tools used by blacksmiths, carriage makers, etc. This firm has the most up-to-date equipment and shops and fully guarantee all their work.

**The H. W. Johns-Manville Co.** have sent us a copy of their Catalogue No. 112, descriptive of the J-M sectional conduit. This conduit is made from a mixture of stoneware clay, fireclay and spar and is intended to replace brick or concrete tunnels for underground piping systems. The conduit is made-up in short lengths, each of which is split longitudinally into halves, so that leaks in pipes are readily located after installation. The system is very fully described, and numerous plans of existing installations are given.

**The Smooth-On Manufacturing Co.,** Jersey City, N.J., have forwarded a small pocket-edition 6¾x4½ in., of their latest catalogue. The general uses of this well-known iron cement are treated, and some particularly hard propositions which this utility has overcome, are illustrated.

We are in receipt of catalogue No. 13 from the **J. T. Slocomb Co.,** of Providence, R.I., illustrating their line of high-grade machinists' tools. The edition is of pocket size, being 5¼ x 7⅛ in., and the cuts are clear and illustrate the tools advantageously. Their line of micrometer calipers is particularly interesting. The book contains a price list also.

**Hans Renold, Ltd.,** of Manchester, Eng., have forwarded us, through their Canadian agents, Jones & Glassco, a very attractive little booklet of pocket size. The outline of the book is the shape of one link of a driving chain, which is the sole product of the firm. A great many interesting facts about the firm and their product form the contents. The high grade and varied application of their chain is dwelt upon at some length. Their silent chain is also well illustrated, and its various uses defined.

**Messrs. Herrgott Bros.,** Mildmay, Ont., have recently issued a new catalog illustrating their threshing machinery and cider mills. Their output has been largely increased due to the fact that they have built an addition to their foundry.

The 1912 edition of the catalogue of the **Heald Machine Co.,** Worcester, Mass., is of rather an elaborate nature. It reflects great credit upon those who were responsible for its appearance. Some excellent cuts of their plant greet the reader upon opening the book. These not only show the magnitude of the establishment and the attractiveness of the various departments of the factory, but the interest taken in the comfort of the employees. Very attractive illustrations of all their machines are shown, together with a complete description on the opposite page. The different forms and types of machines are too numerous to mention here. A useful chapter is one entitled "Points on Grinding" and no operator should fail to read this as a great deal of valuable information is available. A special portion of the book illustrates and describes a drill grinding machine. We are also in receipt of a booklet entitled, "Practical Hints on Internal Grinding" which contains a vast amount of excellent reading and advice. The beauty of it is that the work is very concise and easily understood. Another booklet received from the same firm


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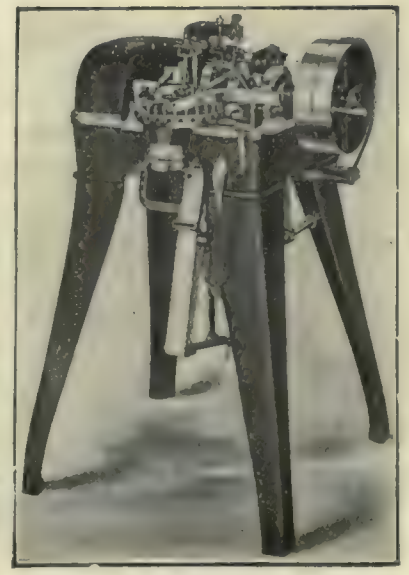

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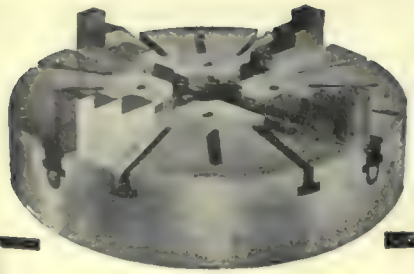

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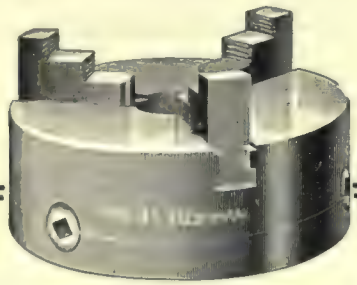

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# Classified Advertisements

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BELTING FOR SALE—800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25 to 75 per cent. less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue, Imperial Belting & Supply Co., 5 Queen Street, Montreal.

BELTING, RUBBER, CANVAS AND LEATHER, hose packing, blacksmith's and mill supplies at lowest price. N. Smith, 138 York Street, Toronto. (2tf)

## MACHINERY FOR SALE

MACHINERY FOR SALE—NEW AND SECOND-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

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WANTED—SECOND-HAND 24 in. x 24 in. x 6 ft. metal planer; must be cheap for cash. Albert Roy, La Patrie, Que.

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contains a very interesting article on "Oversize standards for pistons and rings." A great many good ideas are expressed here. The writer advocates the gasoline engine industry to keep in stock oversize standard pistons and rings to supply to users of engines who have in some manner scored their cylinders so badly that regrinding becomes necessary. The information suggests a great many practices that can be employed profitably by both manufacturer and user. A pamphlet issued by this company entitled, "Cylinder Grinding" contains a wealth of information on this subject and no one interested in this work can afford being without it. Being of pocket size, 3½ inches x 6½ inches, it can be carried with one at all times which certainly enhances its already large field of usefulness.

**The Goodyear Tire & Rubber Co., of Canada, Ltd., Toronto,** have issued the first of a series of booklets to be got out covering all their lines of manufactured mechanical rubber goods. This first booklet deals with Goodyear Rubber Belting for driving, conveyor or elevator purposes, and contains useful hints on the selection and care of belts.

**The Smart-Turner Machine Co.,** Hamilton, have recently received the following orders:—The Wm. Cane & Sons Co., Newmarket, Ont., Duplex Pot Valve Pump; The International Harvester Co., Chatham, Ont., Duplex Pump; The Oxford Foundry Machine Co., Oxford, N.S., Combined Air and Circulating Pump; Beardmore & Co., Acton, Ont., centrifugal pump; S. Caulfield & Sons, Parkdale, Ont., duplex pump; Toronto University, Toronto, centrifugal pump; Hamilton Bridge Works Co., Hamilton, standard duplex pump; J. H. Parent & Frere, Disraeli, Que., standard pump; International Harvester Co., Hamilton, centrifugal pump; The Port Dover Brick & Tile Co., Port Dover, Ont., duplex pump; The Canada Sugar & Refining Co., Montreal, Que., duplex pump.

### BOOK REVIEWS.

"The Prevention of Railroad Accidents," by Geo. Bradshaw, New York. The Norman W. Henley Publishing Co. Price 50 cents. 173 pages, 6½ x 4½ inches, paper covers. The author of this little work was for ten years constantly engaged in the investigation and settlement of claims for personal injuries and deaths arising from railway accidents, and is consequently well qualified to speak of the causes and prevention of same. The book is addressed primarily to railway employes, the author pointing out how numerous are the accidents caused by non-observance, or by careless observance, of apparently unimportant rules. Numerous cuts are interspersed throughout the text, illustrating commonly found conditions that are prolific of disaster to life and limb. Pages 131 to 154 are devoted to safety devices in machine shops and form not the least interesting portion of the book, the whole of which we commend to the attention of railroad men.

### FOUNDRY AND MACHINE SHOP.

The Peterborough Model Foundry & Mfg. Co., Peterborough, Ont., has been incorporated with a capital of 40,000. The incorporators are T. H. Ruble, J. Condon and W. H. Pethie.

The C. O. Clark Brass Co., Montreal, Que., will equip a new brass foundry.

## STUART, DRINKWATER & HINGSTON, LTD.

Incorporation, with a capital of $50,000 has recently been granted to Stuart, Drinkwater & Hingston, Ltd., Montreal, The firm will represent in Canada, the Brush Electrical Engineering Co., London, Eng., dealing in their complete line of electrical machinery, electric rolling stock, and electric supplies. In addition, they will represent Messrs. A. W. Penrose & Co., also of London, Eng., manufacturers of the Penrose electric elevators. They will take over the Canada Ford Co., Ltd., of which Mr. Stuart is president; Mr. Drinkwater, vice-president, and Mr. Hingston, secretary-treasurer—these three gentlemen constituting the sole shareholders of the companies.

# The Western Dry Dock & Shipbuilding Co., Port Arthur

By J. H. Williams

*A description of the dry dock and shipbuilding equipment of a company who recently commenced operations, and are already obtaining a good share of orders. The plant forms one of Port Arthur's principal industries and gave steady employment to about 350 men throughout last winter.*

WITH the establishment of the Western Dry Dock & Shipbuilding Co., Ltd., at Port Arthur, Ont., Canadian inland shipping has been supplied with one of its most pressing needs,—viz., dry dock accommodation at the head of Lake Superior. The company which is an off-shoot of the American Shipbuilding Co. has a fully equipped shipbuilding and repairing plant of the most up-to-date description, and its organization is now complete,—in fact the first ship built on the plant is almost ready for launching.

The site occupied by the company's dock and shops has an area of about 100 acres, so that ample space is provided for future extensions when required.

### The Dry Dock.

The dry-dock was completed at the end of November, 1910, and presents several features of interest. It was designed by Mr. A. V. Powell, of Chicago, and constructed by the Canadian Stewart Co., Ltd. Much thought was given to the question of its dimensions, with a view to providing for larger boats than those in common use on the Great Lakes at the present time. Finally, a length of 700 feet was decided upon. The largest lake freighters at present in use do not exceed 610 feet over all, and experts seem to be agreed that this length cannot be much increased, unless accompanied by an addition to a depth that would render such boats unable to use most of the existing harbors. However, a dock length of 700 feet allows for any freak boat that may be built in the future, and will also accommodate two vessels of a size in common use at present.

The dock is of solid concrete and rests upon a rock foundation. Fig. 5 shows a general view of it, while Figs. 2 and 3 show sections and plan respectively. From these it will be seen that the width at the top is 98 feet 8 inches, and that the depth of water over the portal side is 16 feet. The gate or caisson is of steel, its leading dimensions being given in Fig. 4. It is fitted with five 30-inch flooding valves, and is emptied by a small steam pump situated in the interior above the flood line and provided with steam from a boiler on the dock side.

The dock itself is emptied by two 30-inch centrifugal pumps driven by 200 H.P. direct connected vertical motors. There is also an 8-inch pump of the same type, driven by a 30-H.P. motor; this takes care of the drainage. All three pumps were supplied by the John

Fig. 5—General View of Dock.

Fig. 1—Entrance to Dock. This photograph was taken before the shipbuilding gantry was erected.

inglis Co., Toronto, while the motors are of Westinghouse make.

### Building Berth.

There is at present one building berth situated on the west side of the dock. It is 700 feet long and is served by a 10-ton electric gantry crane supplied by the Wellman, Seaver & Morgan Co., of Cleveland, Ohio. The clearance from ground to underside of crane is 56 feet. On the west side, the gantry is of steel, while on the side next to the dock it is of timber construction to facilitate removal previous to launching—all boats being side launched into the dock. Compressed air headers run the full length of the building berth, the various pneumatic tools being coupled thereto by flexible connections in the usual way. Both sides of the dock are similarly equipped, as are also the various shops throughout the plant.

It is the intention in the near future to construct a second building berth on the opposite side of the dock.

### Ship Construction Equipment.

The punch shed stands in line with and at the head of the dry dock. It is a steel frame building of two storeys, 250 feet long by 160 feet wide. A centre row of steel columns divides the lower floor into two bays, each of which is served by two Pawling and Harnischfeger 7-ton electric traveling cranes. The runways for these cranes extend out beyond the north end of the punch shed, so that they may handle material in the stock yard which is there located. The stock yard is also served by a standard gauge track; so that material passes from cars to punch shed and thence to the building berth with a minimum of handling. Generally speaking the plate work is all done in the west bay of the punch shed, while the east bay is given over to shapes. All machines are driven by individual motors. Those in the west bay include a 32-feet plate edge planer by the John Bertram & Sons Co., 16 feet heavy plate bending rolls by Wickes Bros., two wall radial drills, and eight punches and shears by the London Machine Tool Co., and Hilles & Jones. In the east bay are found the lighter punches and shears, and a bending machine for shapes, supplied by the John Bertram & Sons Co. The motors and gearing of all the punches, etc., are enclosed in substantial wooden housings, to which the motor controllers and switches are affixed. Each machine is served by a 3-ton bracket crane swung from the adjacent column. In annex at the north-east corner of the punch shed are housed the slabs and two flanging furnaces.

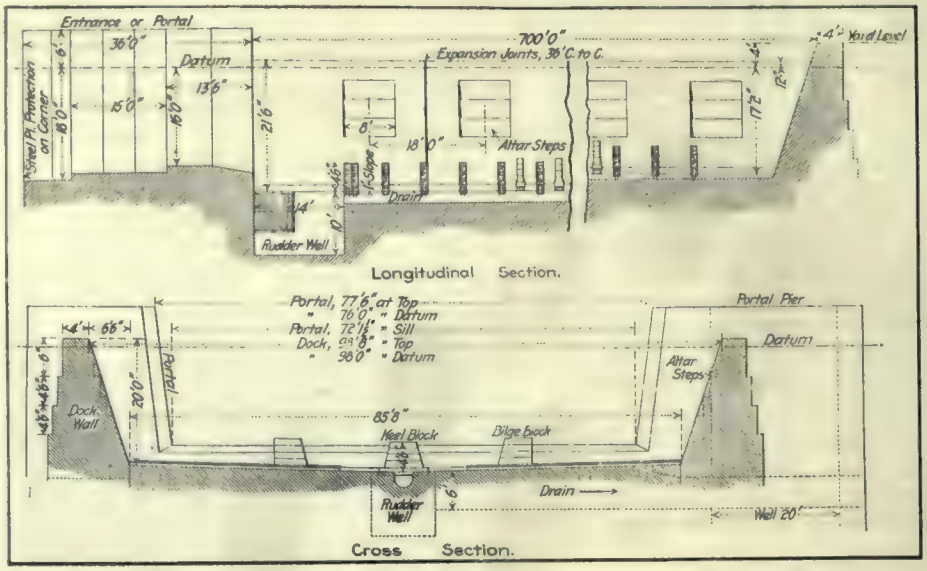



Fig. 2—Sections of Dock.

The mold loft is situated immediately above the punch shed and is of the same area as the latter. It is excellently lighted and contains the usual equipment for making the marking off templets.

### The Boiler Shop.

This shop is well equipped with the most modern tools for the convenient and expeditious handling of boiler and tank work of every description. It is a self-supporting steel frame building with brick walls and a cinder floor, served by standard gauge tracks. The shop is 180 feet long by 90 feet wide and is divided into three bays, of which the centre one is used for assembling purposes, being served by a 20-ton electric traveling crane. All the machines have individual motor drives and are of the most modern construction. Amongst them are included two heavy punches (60-inch throat) and one 48-inch throat shear, by the London Machine Tool Co.; 36-inch throat punch, 18-inch throat shear and horizontal punch by Long and Allstater; one horizontal triple-head Dallett drill, each head being driven by individual motor; one Bertram 4-spindle drill; one radial wall drill and one fixed ditto for drilling large plates. Bolts, stays, etc., are screwed either on an Acme double-head 2-inch bolt cutter or on a 4-inch machine of the same make.

The west bay is devoted to the petty stores and to the flanging and riveting departments. There is a 150-ton hydraulic sectional flanging press served by a 3-ton hydraulic jib crane. Here all flanging, upsetting and dishing is done. The furnace serving the press is 18 ft. long, by 10 ft. 6 in. wide, and is heated by coal fires; draft being provided by a steel stack 42 inches diameter and 60 feet high. Tube sheets, etc., are heated for flanging in a long open fire, which enables 11 feet to be heated at one operation.

Whenever possible, riveting is done on a 125-ton fixed hydraulic riveter of 10 ft. 6 in. gap. The rivets are heated in a small coal fired rivet furnace on the platform. The accumulator for the riveter and flanging press has a 9-inch ram and a 12 ft. stroke, the working

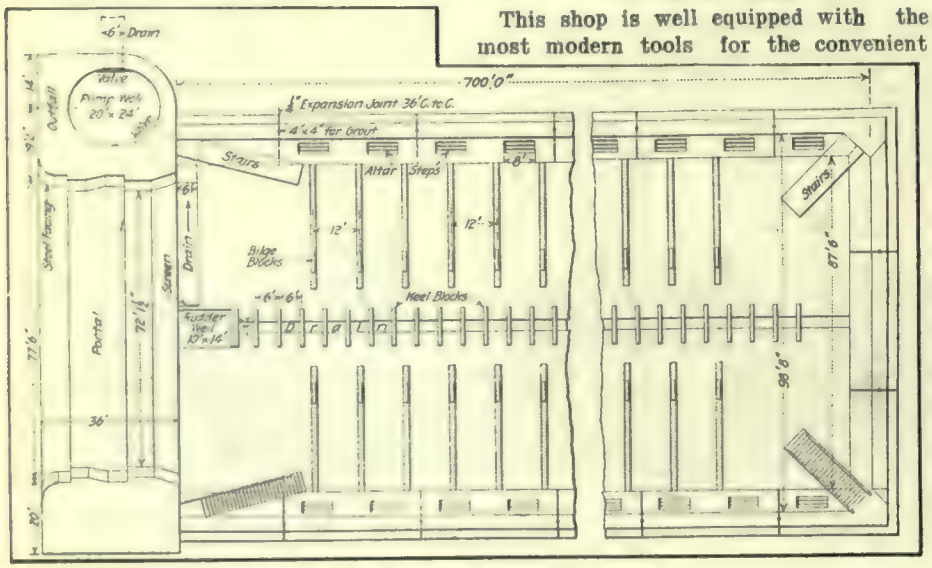



Fig. 3—Plan of Dock.

pressure being 2,000 pounds per square inch. To avoid trouble in winter, oil is used instead of water and is forced to the accumulator by a Deane 2½x12-inch triplex pump driven by a 70 H.P. Westinghouse motor. The accumulator, riveter and flanging press were supplied by the R. D. Wood Co., Philadelphia. Blast for the rivet furnace and open fires is provided by direct coupled motor driven fans.

On completion, all boilers are tested by a motor driven Deane 2½x5-inch triplex pump, the line to the boiler being provided with a safety valve which may be set to any desired test pressure.

### Forge and Machine Shops.

These two departments are at present occupying temporary wooden buildings; but it is the intention to build permanent shops for them this year. The blacksmith shop comprises five forges and one 800-lb Bertram hammer, which is operated by air.

Fig. 7—General View of Boiler Shop.

Most of the machine shop equipment is of Canadian manufacture, with individual motor drive. The John Bertram & Sons Co. supplied a 60-inch shafting lathe, taking 22 ft. 4 ins., between centres; 26 in. engine lathe, taking 10 ft. between centres (motor controlled from carriage); 24-inch shaper; and 48-inch radial drill. The London Machine Tool Co. is represented by a 36 in. x 12 ft. planer, with side head; 10-in. engine lathe with geared head; and 24-inch slotter. There is also an 18-in. engine lathe by the Canada Machinery Corporation and a group drive, comprising one 2-inch and one 8-inch Bignall & Keeler pipe threading machines, Acme bolt cutter, 18 in. engine lathe by Schumacher & Boye, and a double emery grinder.

The company have recently constructed a motor driven boring bar of 10 inch. x 12 feet capacity, for boring out stern tubes, and also have a hand operated bar—6 inches x 10 feet capacity—for reboring the cylinders of tugs, etc., when in position.

The machine shop has a well equipped tool store, behind which is located the general material store for valves, pipe fittings, bolts, etc. The upper end of the shop is at present given over to the pattern makers and ship carpenters, and is fully equipped with the necessary wood-working machinery.

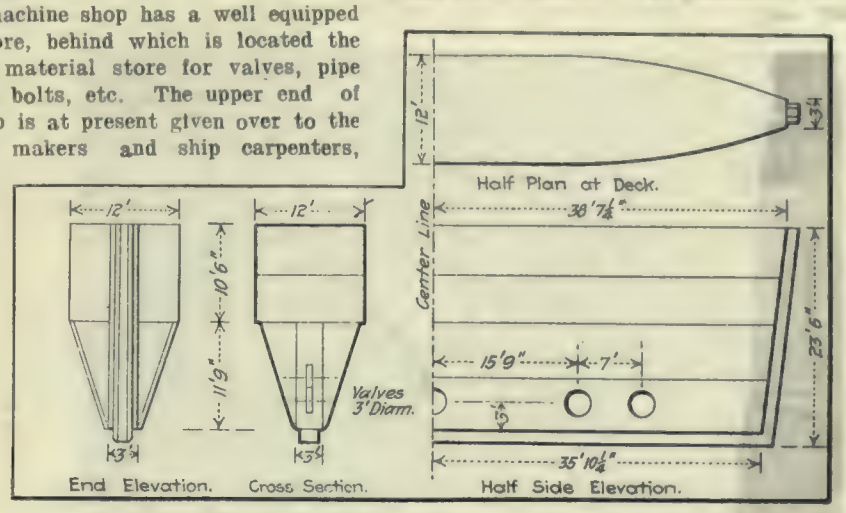



Fig. 4—Dock Gate or Caisson.

### Power House.

The power house is situated near the entrance to the dock and contains two motor generator sets each of 250 H.P. generator capacity. The generators are driven by 30-inch belts from 350 H.P. motors taking city current (A.C.) at 2,200 volts. Compressed air is supplied by a Rand air compressor having a capacity of 1,200 cubic feet of free air per minute. This is belt driven by a 200 H.P. motor and delivers air at 100 lbs. pressure. There is an exactly similar compressor in the machine shop.

Water service throughout the plant is provided by a Deane motor driven two-throw pump taking water from Lake Superior. Provision is also made for using city water if required; the latter being always used for drinking purposes. The shops are lighted by enclosed and flame arc lamps, while the building berth and dock are wired for portable incandescent lamps on extension cables.

### Work in Hand.

The company are just completing their first vessel. This is the S.S. Hamiltonian, a steel vessel built for the Norcross Bros. Co., Toronto. She is 257 feet long over all, 42½ feet beam and 26½ feet molded depth; being of the

Fig. 6—Punch Shed and Gantry.

maximum size that will pass through the Welland Canal. She is a package freighter and is equipped with a full complement of winches, derricks, etc., for handling this class of goods. Her hull is constructed with longitudinal framing on the Isherwood system, for which the Western Dry-dock and Shipbuilding Co. hold the sole Canadian rights for the Great Lakes. She has a single four-bladed sectional propeller, driven by a 3-crank triple expansion engine with cylinders 18, 24 and 48 inches diameter by 40 inches stroke. The jet condenser is fitted with an Edwards air pump. Steam at 175 lbs. pressure is supplied by two Scotch marine single-ended boilers, 11 feet 6 inches in diameter by 11 feet 6 inches long. Each boiler has two Morrison suspension furnaces, and induced draft on the Ellis and Eaves system is fitted.

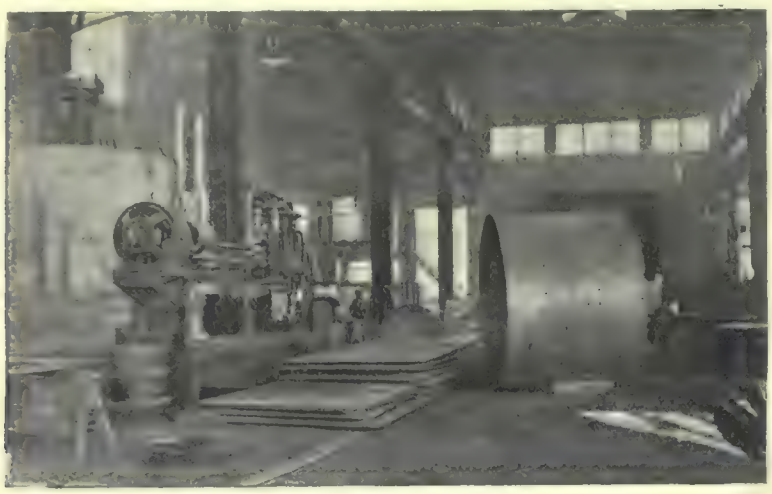


Fig. 8—Centre Bay of Boiler Shop.

The hull, being built on the Isherwood system, will increase her cargo-carrying capacity about 10 per cent. as compared with a vessel of the same size having the usual system of cross framing. In passing through the canals, vessels frequently have considerable side wind to contend with, and are sometimes driven against the stone locks, corrugating the plating and breaking off rivet heads immediately above the tank top. Water leakage results and damages the cargo. To overcome this trouble the Hamiltonian's tank, from boiler room to forepeak, is carried 9 feet up the sides. Thus any leakage resulting from sheared off rivets will go to the double bottom instead of into the cargo.

Orders lately received include a steel stern wheel steamer for the C.P.R. service on the Kootenay Lake. This vessel will be 200 feet long between perpendiculars, 40 feet beam and 8 feet deep. The engines will be tandem compound with cylinders 16⅜ and 35⅜ inches diameter by 96 inches stroke. Steam will be generated by a locomotive type boiler 8 feet in diameter by 28 feet 4 in. long with working pressure of 200 lbs. per square inch.

Another important order lately received calls for a large steel passenger vessel for the Northern Navigation Co. on the same lines as the Hamonic. The vessel will be of steel, 385 long, 52 feet beam and 28.75 feet depth. She will be fitted with a four-cylinder triple expansion engine; steam being furnished by four Scotch type boilers. She will cost about $750,000, and it is planned to have the launching take place in June, 1918.

Fig. 9—Exterior of Boiler Shop.

Fig. 10—Waterfront and 70-ton sheer legs. Boiler shop, punch shed, etc., in background.

## A BIG POWER PLANT SAVING.

The analysis of boiler compounds as an end in itself presents little to excite enthusiasm, says Arthur D. Little, president of the American Chemical Society, but when such analyses are made the means of saving $3,600 a year in the power plants of a single company they take on a new and larger aspect, not only in the mind of the chemist, but in the mind of the chemist's client.

## DEVELOPED WATER-POWERS.

As a result of investigations undertaken by the Commission of Conservation, it has been ascertained that there are 1,016,521 horsepower developed from waterpower in Canada.

# Prominent Features of Forge Practice in English Shops, II.

By Joseph Horner

*The writer is well and favorably known through his contributions to the editorial columns of the leading technical journals of Great Britain and the United States. Concerning Canada, he is no stranger, having on previous occasions furnished highly instructive information to readers of Canadian Machinery on important developments in mechanical engineering practice. The subject of the present series of articles will be found extremely interesting, enabling, as it does, a close comparison between British and Canadian methods to be made, and perhaps profitable hints extracted.*

SMALL forgings made in large quantities are now probably hardly every produced by hand methods, but are stamped wholly in dies. There are two classes of shops dealing with this

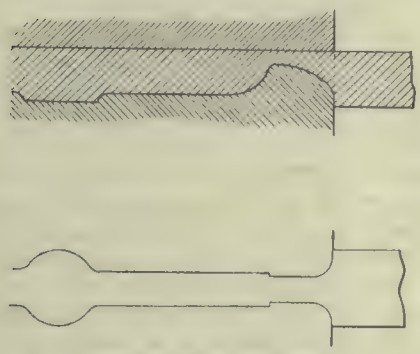


Fig. 13—Forge Practice.

kind of work—those which make their own and those who buy out. A number of big firms now supply stampings to the trade, and where the quantity required is only moderate, it is cheaper to buy than to lay down a plant. Some firms again have a stamping department as an auxiliary to their ordinary smithy. Such a system once introduced inevitably grows, just as does that of machine moulding in a foundry, because the possession and accumulation of dies tends to standardization of similar parts. Little differences in dimensions which have no justification in point of strength or appearance are obliterated, and a few averaged sets of dimensions supply the place of a heterogeneous and perfectly useless lot of variations evolved from the fancy of the draughtsman. Moreover, as the numbers which are stamped increase, a better class of dies is evolved, the cut steel does taking the place of cast-iron for attachment to tup and anvil. This practice of drop-forging is now very extensively adopted. A few years since it was seldom seen outside the small arms, cycle and similar factories, and a few firms who made a specialty of small mechanisms; excluding, of course, the shops which supplied stampings to the trade. Now, it has become familiar in many general engineers' establishments where specialities are handled, being favored and fostered by the pressure of competition, the increasing specialization of manufactures and the necessity for interchange ability.

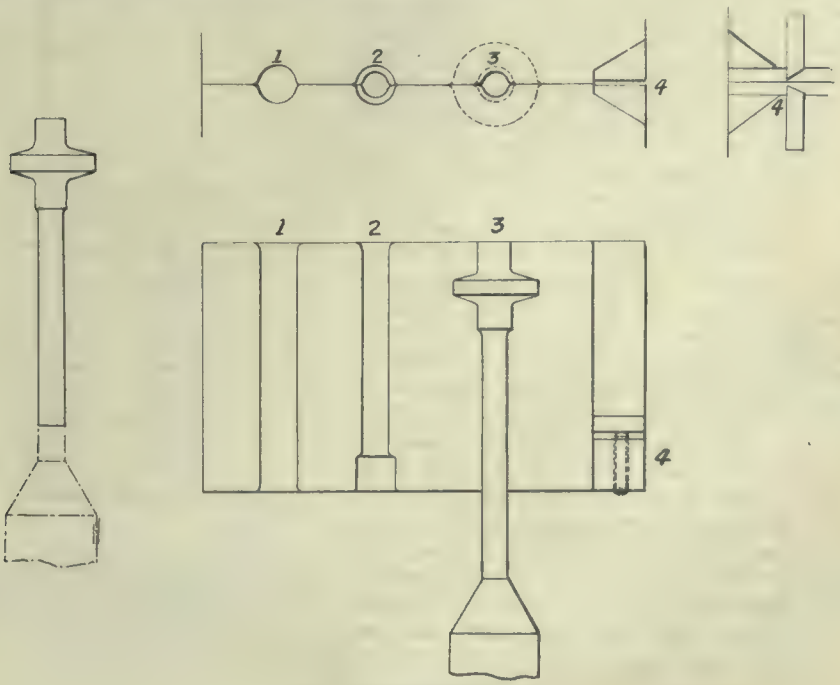



Fig. 12—Forge Practice.

**Power Hammer Improvements.**

Improvements in power hammers have, however, been greatly contributory to this result. The old belt and board drop hammers, long familiar in the Birmingham district, operated by foot or hand of the workman, have been succeeded by better English and American forms. The American-Bradley cushioned hammer has had a large and appreciative patronage, and the English-Brett lifter hammer has been extensively installed in many English and Continental shops.

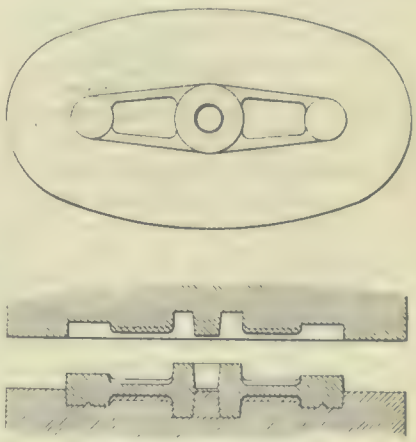


Fig. 15—Forge Practice.

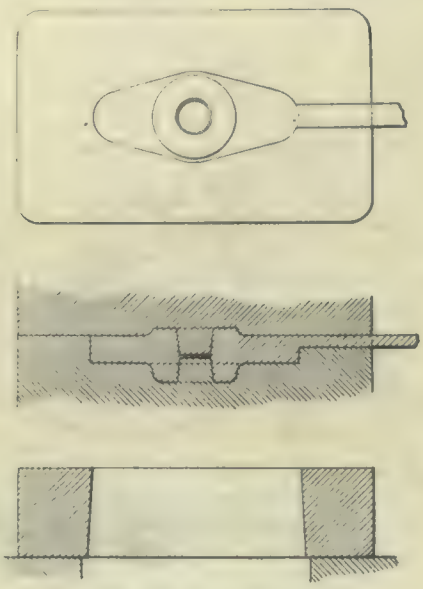


Fig. 14—Forge Practice.

These, and the types of which they are broadly representative, are operated by steam or compressed air, and are varied in design to suit all classes of forgings. They deliver a rapid succession of blows, the frequency of which is entirely under control of the attendant, and they can be rendered automatic at will, working slowly or quickly, with a predetermined height of lift. The metal is

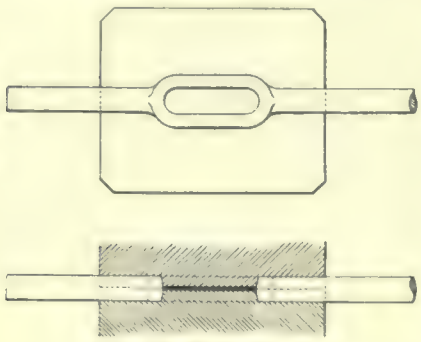


Fig. 16—Forge Practice.

consolidated and the surface left highly polished. Steel is used more extensively than iron, because no trouble occurs with direction of fibre. No forgings made thus are of large dimensions.

The very general substitution of mild steel for wrought iron has been favorable to the growth of stamping in dies. In iron forgings the direction of the fibre is of so great importance that forgings which involve much curve-hooks, forked ends, eyes, loops and similar articles must be bent preliminary to the work of stamping, and this bending in many cases also involves a weld. In mild steel, however, all such can be stamped from solid lumps, because there is no fibre causing weakening when cut across. Large quantities of odd ends of steel are used in this way, and which as scrap would fetch little.

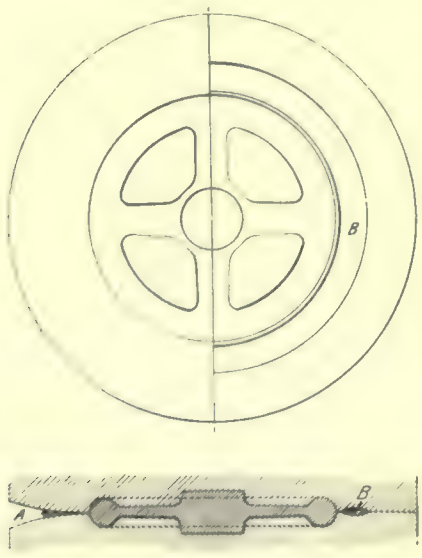



Fig. 17—Forge Practice.

**Scope of Drop Forging Practice.**

Drop-forging practice must be controlled by the bulk or mass of the particular work done and by its character. The largest proportion comprises what may be included under the term lumps, which are produced from solid masses; none of which are of very large dimensions. Lumps or single solid masses are forged from bars of suitable cross sectional area. These include numerous small parts for engines, cranes, machine tools, machines and small tools of various kinds. On these no preliminary work is done, but the bar is heated and set at once in the dies, roughed, finished and stripped at one heat.. In making articles of small dimensions, two, and sometimes three forgings are done at one heat and cut off. Sometimes odds and ends are utilized, in which case a porter bar is frequently welded on by which to hold the forging. The simpler the forging the more rapidly can it be produced. The term, simplicity of a forging used in this sense, does not convey quite the same meaning that it would to a man working at the anvil. A forging may be intricate in the sense of being of irregular outline without entailing any extra work or trouble in stamping it. It is not simple in this sense, if more than one set of dies has to be used, if setting, after forging, has to be done, or if a loose piece has to be inserted to punch a hole, or to form the hollow of a fork, and so on.

**Class of Forgings.**

The simplest forgings are those which are wholly circular, though a rectangle in continuation of the cylindrical portion matters little; the reason being that the work, when circular, is rotated in the dies between each blow, Fig. 12, and the required dimensions and shape are soon obtained. Such forging is usually begun and completed between one pair of dies, but in successive stages; reducing from larger to smaller recesses and thus easing the work. Even though one part is much larger than another, as in a valve and its stem, Fig. 12, forged solidly, upsetting is not done, neither is welding, any of which methods might be adopted at the anvil; drawing down only being practised. This is done in stages, usually in one pair of dies only, but sometimes in two pairs on adjacent hammers, the finish being imparted in the final recesses of the exact shape, Fig. 12. Here, the recesses for the successive operations are marked in order, 1, 2, 3, 4. This is work of the kind which has no fin, and, therefore, requires no stripping because it is rapidly rotated, and the fin which begins to form is suppressed at the successive turns. In the dies for such articles, keen edges are not left, but the edges instead are slightly convex, Fig. 12. Again, the recesses in the dies need not be semicircles, nor the faces close together when the work is down to size. Work produced thus has a fine and glossy surface finish, suitable enough for many purposes without tooling of any kind. Cutting off is usually provided in the dies for shapes of this

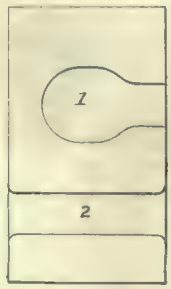
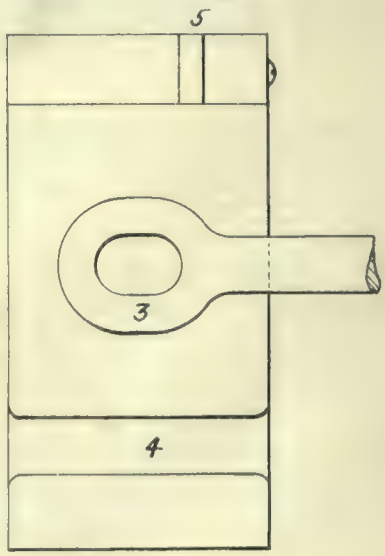



Fig. 18—Forge Practice.

kind, Fig. 12 (4). In others, the finishing grooves are terminated in a narrow neck, Fig. 13, which reduces the area or diameter there, so greatly, that the forging is practically severed.

Those forgings which are flat cannot be turned about in the dies. These can often be gradually broken down in two or more recesses or in some cases a forging can be roughed and completed in one operation as happens where there are no great discrepancies in adjacent dimensions, Fig. 14. A fin, however, is unavoidable, and the rapid removal of this requires the aid of the stripping die, seen in the lower part of Fig. 14.



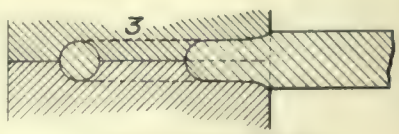




Fig. 19—Forge Practice.

This is sometimes in one with the forging die adjacent, but is more usually distinct from it on the same or a separate anvil. The profile of its opening is exactly that of the forging but tapered downwards. A slight hammer blow drives the forging, laid redhot on the stripper, through the latter, and removes the fin cleanly and easily.

When holes are made in die forgings they are usually produced with punches which are part of the dies, Figs. 14, 15, and 16, instead of by using a separate punch as is generally done at the anvil, and in dies which simply supplement and finish anvil work as illustrated in the last article. If the forging is shallow, a single punch suffices. If of fair depth, two are preferable in top and bottom dies. They must be well tapered and not quite meet at the centre; the fin left being driven out with a drift.

When a considerable quantity of fin is formed, the stripping die is necessarily used. It is convenient, but when there does not happen to be room on one anvil, or no adjacent hammer, the fin may be

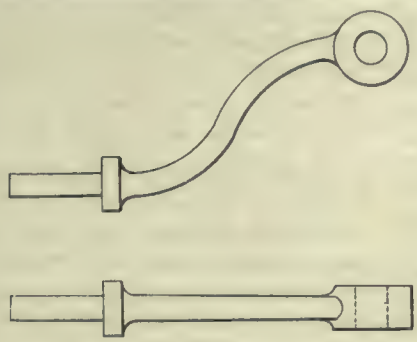


Fig. 20 -Forge Practice.

knocked off with a hand hammer immediately the forging is taken from the die. In these cases, provision is often made to reduce the thickness of the fin next the forging. This is accomplished in one of two ways; either by imparting the shape seen at A in Fig. 17, or that at B. In either case, ample room is left to the fin to be squeezed out, while around its zone of attachment, it is extremely thin.

**Removal of Forgings from the Dies.**

Another thing to be noticed is getting the forgings out of the dies. In Fig. 12 the bar, from which the valve stems are forged in succession, forms a porter bar by which the forgings are manipulated and rotated. Fig. 13 shows a similar case. In Fig. 14 a porter is welded on the lump immediately before it is put into the die, a groove being provided for the bar to lie in. In Figs. 15 and 17 no provision is made, but the forgings are easily lifted out by prying under the fin which forms. Sometimes kickers are fitted under the die which knock out the forging from below, the kicker being operated by striking a lever with a hammer, or by a pedal, or in some cases with an hydraulic cylinder.

Figs. 18 and 19 illustrate the making of a forging in two dies under adjacent hammers. In the first Fig., the forging shown at A, is roughed into a solid globular form at 1, and the stem roughed down in the groove 2, adjacent on the dies, one half of which is seen in plan. In the second figure, the eye is finished in 3, the stem in 4, and the bar cut off at 5.

**Bent or Curved Outline Work.**

A considerable volume of work is of bent or curved outline in the longitudinal direction. This may or may not be stamped, thus, in the dies. In the engineers' smithy and in heavy forgings the bending is more conveniently done at a second stage. For example, in Fig. 20, the upper and second figure illustrate a bent forging as made at one operation. The lower figure shows it as made straight to be bent afterwards. A block would be provided on which to bend it. Fig. 21 is another familiar article which is made by either method. If these are done at one heat a rough preliminary bending is desirable in order to avoid much waste of material and much fin. These are examples of rather lumpy pieces. Forgings which are bent in plate and bar come under another grouping to be dealt with in the next article.

Only when very considerable differences exist between adjacent sections is the practice of reduction or drawing-down departed from. This occurs in consequence either of great differences in sections or in lengths. Large bosses on small webs are representative of the first and bosses and eyes on long rods are typical of the second. In examples of the first kind, the bosses are frequently welded to the web in preference to drawing-down. In the second class, a short portion of rod or web is drawn down from the boss, the rod portion being scarfed and welded to the main rod.

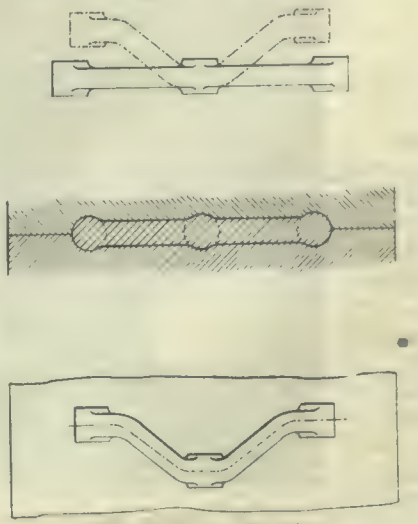


Fig. 21—Forge Practice.

## AN OIL FUEL LOCOMOTIVE.

The first locomotive in Scotland to be fitted with oil fuel apparatus has just been put in service by the Caledonian Railway. The engine has an ordinary coal tender, but on the top of the tender there has been placed a tank having a capacity for 520 gallons of oil, from which a pipe is led to the furnace. The pipe branches out to either side, and allows the oil to enter through two injectors placed 18 in. apart. From these injectors the oil is sprayed into the furnace by steam, and is spread over the bars, and over a small quantity of coal which is required to facilitate combustion and to keep a fire in the furnace when the oil supply is turned off.

The oil feed is regulated by a controlling valve on each of the injectors, and the fire box is specially protected in order to withstand the intense heat. When drawing only the tender and one saloon carriage the fuel consumption is 1 1-2 lbs. per mile, and when drawing a full train it is 27 lbs. per mile. The present supply tank is sufficient for a run of 140 miles.

## THE CANADIAN GENERAL ELECTRIC CO.

The Canadian General Electric Co., who at present occupy the building at the corner of St. Sacrament and St. Peter streets, Montreal, have purchased an extensive property on the south side of St. Antoine street, opposite the new Canadian Pacific Windsor street station, upon which they will commence this spring the erection of a handsome office and warehouse building to be used exclusively by the Canadian General Electric Co. and the Canada Foundry Co., Ltd. The building, which has been designed by Messrs. Ross & McFarlane, architects, Montreal, will be a handsome structure of cut stone and brick, consisting of five storeys and basement. The offices, showrooms, and warehouse floors will be equipped with every modern device for facilitating dispatch of business, and will afford ample space for the company's rapidly increasing trade.

The Canadian General Electric Co. have within the last two or three years either purchased or erected suitable buildings for their requirements in Halifax, Toronto, Winnipeg and Vancouver, and the erection of the Montreal building is in pursuance of their policy to provide every possible facility for taking care of the growth of business.

Railways are the great purchasers of materials of many kinds, and the moment they are forced to stop buying the effect begins to be felt in the forest, the mine, the mill and the factory.

# The Chain Drive as a Power Transmission Medium

By C. T. R.

*The contents of this article tell of the increasing popularity of the Chain Drive over a wide field of application and indicate that while its adaptability may be in numerous circumstances limited, there is, nevertheless, with the continued improvements being developed in design and quality of material, a strong possibility of its scope being still further extended.*

ALTHOUGH the question of power transmission is only one of many to which the engineer has to give his attention, yet in these days of great and increasing activity, it comes about that none of us can afford to be indifferent to any factor which makes for better, quicker or cheaper production. Plants, factories and mills are extending in every direction as the supply falls short of the demand, and it is the engineer with the knowledge of where to save, who is mainly responsible for these extensions. That chain driving, which has many advantages over other methods of power transmission in many cases is a factor of considerable importance, is evidenced by the fact that in every part of the world engineers are using this drive to a large extent.

### Record of Chain Drive Output.

Recent enquiry from the Canadian representatives of the originators and pioneers of chain driving, Hans Renold, Ltd., Manchester, England, elicited the information that this firm's output during the last five years, for chain drives for strictly engineering use was as follows:—

| | H.P. |
|---|---|
| 1907 ... ... ... ... ... | 30,500 |
| 1908 ... ... ... ... ... | 43,000 |
| 1909 ... ... ... ... ... | 48,100 |
| 1910 ... ... ... ... ... | 67,360 |
| 1911 ... ... ... ... ... | 99,600 |

### Particulars of Installations.

The field of application for chain driving is unlimited. In Great Britain, drives ranging in size from ⅛ to 500 h.p. may be found doing duty under all sorts of conditions from the dish-washing machine in a provincial hotel, to the main shafts of mammoth steel rolling mills. Chain drives have been in operation with great success in the South African gold mines since the stamps first dropped, and one new textile plant in India has just placed an order for chain driving equipment valued at $30,000.

Canada has perhaps adopted chain driving more generally than other countries, as, of course, her development has taken place during the last decade. From Newfoundland to the lumber mills of the Pacific coast, from the hydro-electric stations at the Niagara Falls and the paper mills of the Soo to the Saguenay district and the mines of Northern Ontario, chain drives—which have proved their high efficiency and great durability under what were in many cases new and severe conditions—may be found. Nor does one find the chain drive used in isolated cases only. The experimental stage has long since passed, else one would not see such complete installations as that of the Wayagamack Pulp & Paper Company, who in their new mills at Three Rivers used over 40 Renold Chain Drives transmitting from 5 h.p. to 100 h.p.

One of the most interesting of the many complete installations of chain drives in this country is that of a prominent eastern firm who, having to increase their plant, duplicated the existing six-storey building, using similar equipment throughout the new addition, with the exception that the power was transmitted from one motor by means of chains to the different floors instead of by belt and ropes as formerly. Needless to say such a departure from old and tried methods was not made without the engineers studying carefully the advantages of chain driving generally.

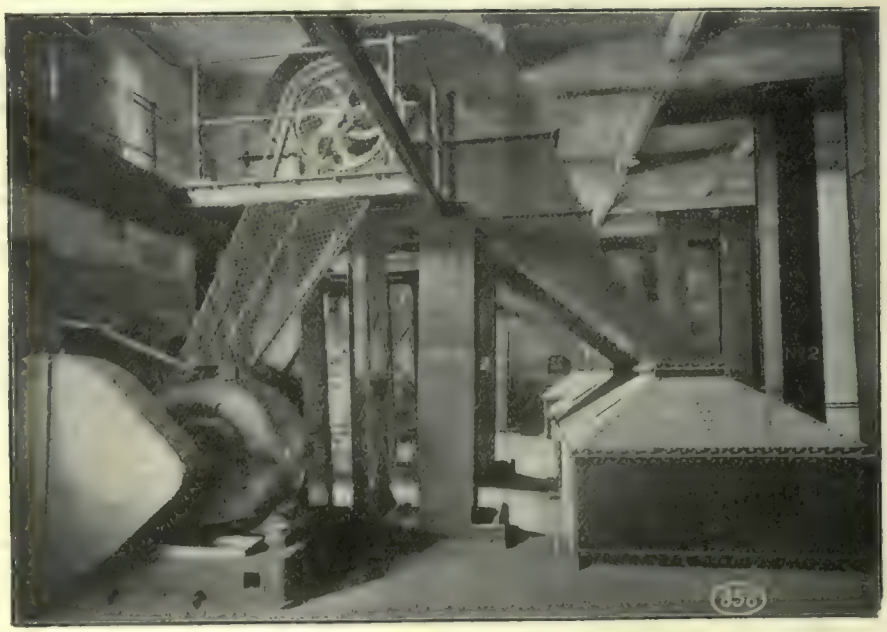
### Summary of Design and Application.

Space does not permit us to discuss the design of chains and their various applications, but it might be well to summarize some of the advantages:

(1)—It is positive, inasmuch as the chain cannot slip in the wheels. It is elastic, inasmuch as the weight of the chain which hangs between the wheels may act as a spring; the lubricant in the bearings and in certain cases even the shapes of the links adding to this quality. The effect of this elasticity is to considerably reduce the vibration and noise which is inseparable from such a positive power transmission as spur gearing, while the positive nature of the chain drive has in many cases increased the production of machines from 15 to 30 per cent.

(2)—Chain driving is highly efficient; experiments having shown that the efficiency of a well-designed chain drive is somewhere between 97-98½ per cent. Also, the nature of the action of the chain upon the wheels is such that this high efficiency is maintained throughout the life of the drive and is not seriously affected by minute inaccuracies of erection, as is the case with some forms of tooth gearing.

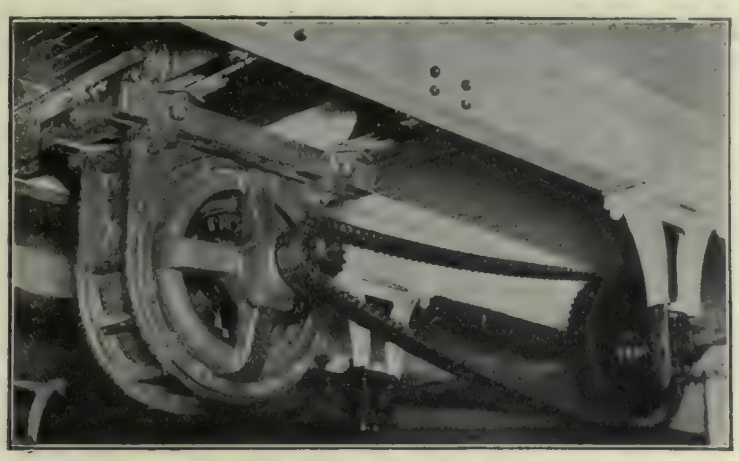
(3)—As compared with rope or belt, the centre distance for chain driving never exceeds 8 feet or 9 feet and can, if circumstances require, be made so small that the chain wheels barely clear one another. For this reason it is even possible to take out a pair of spur wheels, replace them by chain wheels of smaller diameter and get, as the result,



One of eight drives forming part of an installation of over forty Renold Chain drives in a grain elevator in Great Britain.

a highly satisfactory drive as regards efficiency and absence of noise and vibration.

Partly on account of the above advantages, and partly because it is not necessary that there should be any greater initial tension in the chain than such as is caused by its own weight, there are very heavy incidental economies, effected by chain driving. The absence of tension results both in saving of power and in reduction of wear and tear of bearings, shafting and machine parts. In conclusion, we believe that chain driving —which must be classified among the prominent methods of power transmission for strictly engineering purposes— will continue to grow in popularity, and in fact, become recognized as a standard system.



One of five 35 H.P. Renold Chain drives installed by Jones & Glassco, Montreal, in a prominent new Montreal plant.

# Layout and Equipment of the Blacksmiths Shop

By Frank Walker

*The writer will be remembered as having contributed to our columns recently, a paper on "Hardening and Tempering Carbon Steel Tools," and the widespread appreciation brought to our notice then, will, we are sure be once more evident in the present instance. The requirements of the Blacksmiths' Department are treated in the following pages in a thoroughly practical manner, and show in every detail, a familiarity with and intimate grasp of the subject.*

IT has often struck the writer that the blacksmith's department, especially in small engineering establishments, does not receive that amount of consideration and attention to which the work justly entitles it. The blacksmith's art is indispensable to every industry and many of the professions, and his work, even under the most favorable circumstances, is performed under conditions which obtain in no other trade or handicraft. His material must be heated before it can be worked into shape, and, therefore, must be held and turned by means of tongs. The duration of the heat limits the time at his disposal in which to effect the operation in view, and while the work is heating he must think out his plan of action, so that the greatest amount of work may be done while the heat lasts. Under these conditions, it is surely false economy to handicap him still further by an ill-arranged and badly lighted working place, and a scarcity of efficient tools. The blacksmith is practically the only mechanic who makes his own tools, and too often insufficient time is allowed him either to make new tools or repair the old ones.

The advent of steel and malleable cast iron has no doubt greatly simplified his work, as many intricate machine parts which were formerly forged are now cast in one or other of these materials, but it still remains that the blacksmith's trade is the most important of those involved in engineering construction and maintenance. The forge equipment and its arrangement, for an expeditious and economic output, should be, in the writer's opinion, as shown and described in the following article.

### Shop Lay-out.

The first thing to be considered is the amount of space required for each forge. This will depend, of course, very much upon the class of work to be done, but it is, in all cases, necessary to have sufficient head-room to insure good ventilation and an abundance of light. The height should never be less than 16 feet, and, if heavy work is contemplated, this may be increased with advantage by 4 or 5 feet more. Windows of liberal size must also be provided. Should two or more forges be required, by far the best arrangement for general work is to place them in a row along the wall of the shop at a distance of 4 feet, measured from the wall to the nozzle of the tuyere, and 16 feet apart centre to centre, with a window between each pair.

The anvil should be placed 6 feet from the tuyere and 5 feet from the centre line of the forge, in such a position that the blacksmith turns to the right to place the heated work upon it. The beckhorn of the anvil should point to his left. The space for the helper at the back of the anvil should be not less than 10 feet wide, and in large shops where the forges are situated on either side, the space between the rows of anvils should not be less than 25 feet, with the steam-hammers and other general tools ranged up the centre.

At those forges where heavy work is done, a swage-block should be provided. This should be placed at the right hand side of the anvil, and 5 feet from and in line with the anvil, that is, the same distance, 10 feet from the wall. Also, over the heavy forges, a swinging jib-crane should be installed. Its jib, fitted with a runner carrying a pair of chain blocks should be sufficiently long to command the anvil and swage-block and sufficiently high to clear the swinging of a sledge. The best position for the cooling trough, or "bosh," as it is sometimes called, is immediately in front of the forge, so that it is close to the blacksmith's right hand, as he stands at the fire.

Immediately to the right of the anvil a small stand should be situated, on which the blacksmith can place such tools as he requires for immediate use, and under this stand, sunk in the floor, a small cooling trough should be placed, in order that the edges of setts and gauges may be quickly cooled when cutting large pieces on the anvil.

Directly at the back of the anvil, on the side away from the smith, a heavy cast iron block should be sunk in the floor; on this block work of medium length may be upset or "jumped." A tool bench should be placed against the wall, on which the top and bottom anvil tools, swages, fullers, etc., may be kept, and fixed to the wall on either side of the tool bench should be racks for the tongs.

At the side of the blacksmith and directly at the back of the next forge,

a bin to hold a supply of fuel should be placed.

The plan, Fig. 1, clearly shows the position of the various items of the equipment.

Not the least important part of the blacksmith's shop is its floor, and opinions vary very much as to what is the best material to use. The writer has found nothing better than brick-earth or clay mixed with ashes, in the proportion of 3 of earth to 2 of ashes. This, if watered once or twice a day, sets most firmly and makes an ideal working stand.

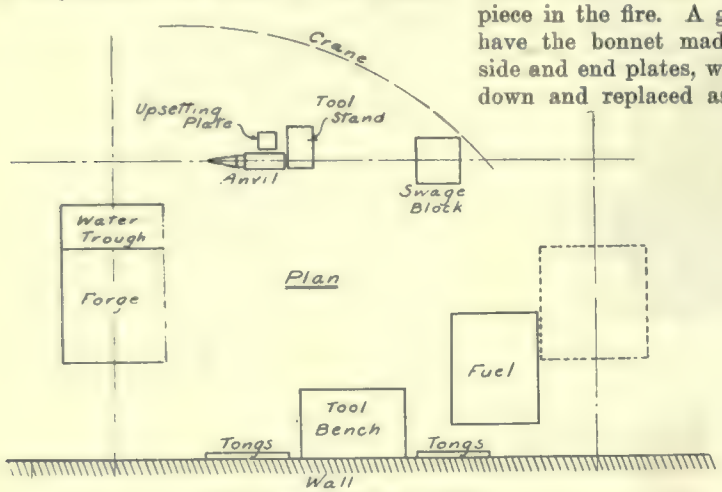


Fig. 1—Equipment Lay-out.

Having described the general arrangement of the forge I will now proceed to discuss each item and the various tools in detail. There are, however, numerous tools and other apparatus in the general equipment which are used occasionally only; these I propose to describe later.

### The Forge.

The forge or hearth may be constructed of a variety of materials, cast or wrought iron, stone, brick, or even concrete. It matters little which, as long as the means of obtaining and maintaining the required heat are satisfactory, and that there is an efficient bonnet and chimney-stack to carry off the smoke and gas. The size best adapted for general work is 45 in. square, with height of 30 in. The blast should be introduced through the breast wall by means of a water jacketted tuyere. This should project into the hearth 9 in. and be at a depth of 6 in. below the level of the hearth plate. The bottom of the forge should be at least 6 in. below the tuyere, in order that dust and clinkers may collect without choking the blast. The orifice of the tuyere should be 1⅜ in. diameter, and the supply pipe leading from the blast trunk 3½ in. diameter. A windgate or shutter must be placed in the supply pipe, directly behind the breast wall. This is actuated by a lever placed close to the blacksmith's left hand. The tank for supplying water to the tuyere jacket must also be at the back of the breast and placed about 1 foot above the centre of the tuyere. The chimney stack must be not less than 10 in. diameter, and be carried far enough through the roof to insure a good up-draft. It should be kept well back and the bonnet made as narrow as possible, in order to clear the crane blocks when working a heavy piece in the fire. A good practice is to have the bonnet made with removable side and end plates, which may be taken down and replaced as required.

### The Anvil.

The anvil for general machine blacksmithing should be of the standard pattern, of wrought iron with a steel face, and its weight from 300 to 350 lbs. Where several anvils of the same weight and pattern are used, care should be taken that the square hole for the tool shank is straight and of the same size in each, so that tools made for either anvil may be used in the others without danger of jamming and breaking the shanks.

The anvil may be mounted on a wooden block, but by far the best practice is to mount it on a hollow cast iron base, as shown in Fig. 2. It will be seen that the weight is carried by a substantial flange. Inside the base and 3 inches from the top edge, fitting snugly on this flange, a hardwood block 2 inches thick should be placed, forming a cushion for the anvil to rest on. The back and front top edges of the base are cut away as shown, in order that the scale may find its way onto the floor and not work under the anvil. In setting the anvil the back edge should be kept about ⅛-in. lower than the front, that is, the face should incline from the smith by that amount. This makes the work much easier to handle. Care should be taken when working, not to leave large heats on the anvil longer than absolutely necessary, as this has a tendency to draw the temper and soften the face.

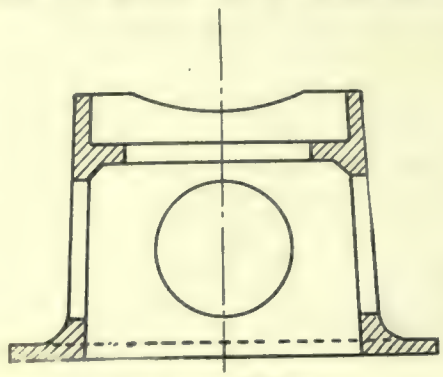


Fig. 2—Anvil Stand.

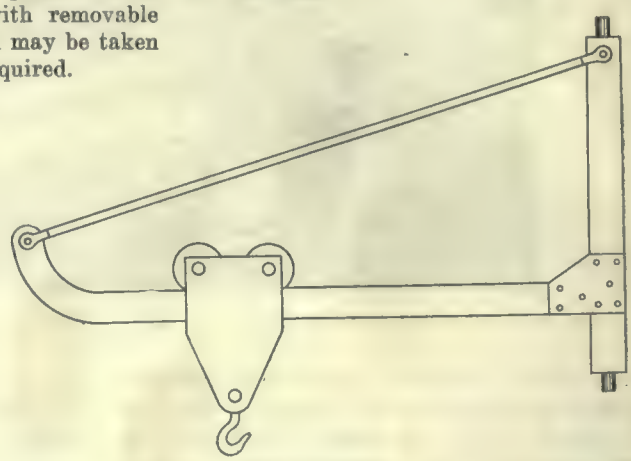


Fig. 4—Crane.

### The Swage Block.

The swage block is an extremely useful tool; the best type for general work being the rectangular one, having its edges indented for swaging square, round and hexagon work, and its centre pierced by square and round holes for heading. One side of these holes should be countersunk. It should be supported on a cast iron base as shown in Fig. 3, so that it may be securely held on its edge for swaging or on its flat for heading. The swage block is also very handy to use as a bolster for punching and drifting collars and washers.

### Cooling Troughs—Tool Stands—Upsetting Plates.

The cooling troughs may be either cast or wrought iron, the larger one at the forge 42 in. long, 18 in. wide and 21 in. deep, and the smaller one at the anvil 12 in. square and 12 in. deep; the latter being sunk in the floor for a depth of 7 or 8 inches. The tool stand at the anvil should be a plain wrought iron or wooden stool 15 in. wide by 18 in. long, and its height about 3 in. less than that of the anvil. It should be so placed that its legs straddle the small cooling bosh without interfering with access to the water.

The upsetting plate should be a plain rectangular block of cast iron, 12 in. square by 5 in. thick, sunk level with the floor.

### Tool Bench—Tong Racks.

The tool bench should be substantially built of wood, 42 in. long by 28 in.

wide and 36 in. high, fitted with a drawer in which the smith may keep his private tools, drawings, etc., and a shelf underneath about 1 foot from the floor. At the back and ends, rails should be fited to carry top tools; that is, those with handles. The lighter bottom or shank tools may be kept on the top and the heavier ones on the shelf underneath. Tools should be put away immediately they are done with, and if every tool is kept in its place, much

Fig. 5—Fuel Bin.

valuable time will be saved when they are wanted.

The tong racks are very simply made; a piece of 1 in. round stock with the ends bent at right angles and plugged securely into the wall, about 30 inches from the floor and standing out 3 in. from the wall, answering every purpose. The tongs may be hung over this bar, reins downward.

The jib crane can be very cheaply constructed. Fig. 4 shows the most suitable style and is self-explanatory. The runner shown carries a light set of differential chain blocks, and a small snatch block must be hung on the bottom block hook, with a short endless chain passed through it. The work is carried in this endless chain and can, therefore, be raised, lowered or turned in any direction required. When the crane is not in use it can be swung out of the way and the blocks run back against the wall. This crane will be found much more convenient than trestles or horses for supporting heavy work; being easily adjusted and always at hand when wanted.

Fig. 5 shows a suitable type of fuel bin. This should be 45 in. long, 36 in. wide, 30 in. high and may be made of either cast or wrought iron.

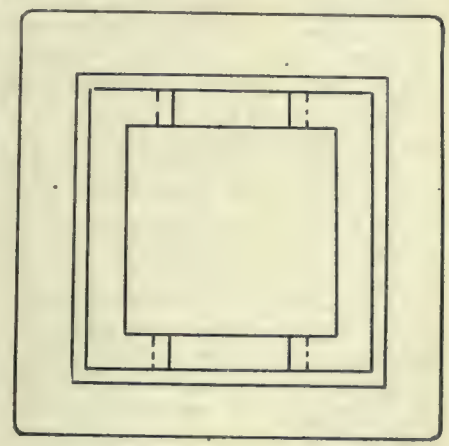
**Working Tools—Hammers.**

The blacksmith's working tools comprise hammers, top and bottom anvil tools, flatters, set hammers, hot and cold setts or chisels, gouges, punches and tongs. Each forge should have five hammers, as follows: The smith's hand hammer or "pointer," of standard ball-peened shape, 1¾ lbs. weight, fixed on a handle 20 in. long, and the "back" hammer, a small double-faced hammer, 4 lbs. weight, with a handle 24 in. long. This hammer should always be kept directly back of the anvil, being found extremely useful for swaging small work to a nice finish or other light jobs. Three striking hammers or sledges are required; one of 8 lbs. and one of 12 lbs. weight for light and medium work, and one of 16 lbs. weight for setting, straightening and heavy striking.

These hammers should be of the cross-peened type, as they are better adapted to working the edges of a scarf when welding. The smith and his helper should pay close attention to the fitting of the hammer handles, as many serious accidents have been caused by hammer heads coming loose and flying off.

**Working Tools—Swages, etc.**

The top and bottom anvil tools, for general machine work, comprise a great variety of shapes, the most common of which are swages and fullers. These should always be made in pairs and accurately matched, and attention given to the following points. Swages must be made so that the depth of the impression is 1-3 the diameter of the work to be finished, and the edges of the ends and sides of the impression must be well rounded off to prevent marking or cutting the work. It is also important that the impression be slightly crowned from end to end. The shank of the bottom swage should not be situated in the centre, but at one end, so that when the swage is placed in the anvil, one end comes flush with the edge. This will enable work to be swaged close up to collars or arms. The swage can also be reversed and used



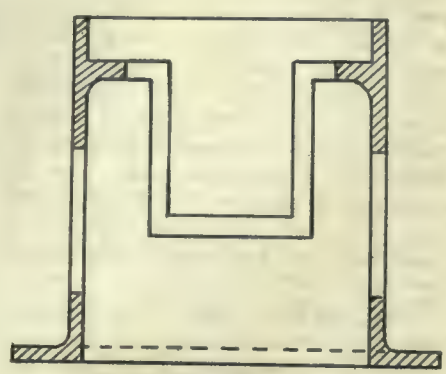


Fig. 3—Swage Block Base.

from the other side of the anvil. The bottom swage should bear fairly on the anvil and the shank must not fit too loosely in the hole. The top swage must be made from ½ to 1 in. shorter than the bottom according to size; the correct length for the bottom part of

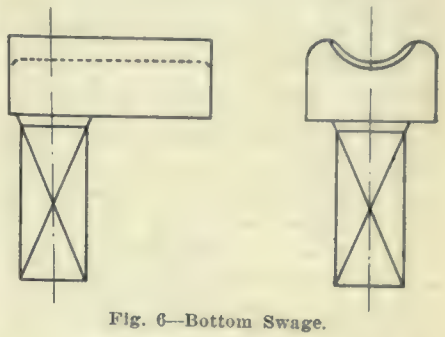


Fig. 6—Bottom Swage.

a 1 in. swage being 3½ in. and of the top part 2¾ in. Fig. 6 shows the correct form of a bottom swage. Care must be taken when forging the top tools not to make the head too light around the eye, as it is here that they most frequently break.

Fullers are not so important as swages, having no sharp edges to come in contact with the work. They should be made accurately in pairs; the bottom part having a wide and sufficient bearing on the anvil and the shank fitting nicely in the hole.

Flatters and set hammers should not be made too large; a good size for the flatter being 2½ in. square, with corners slightly rounded and centre crowned 1-32 in. This gives much better results than a dead flat tool 3 in. square. Three set hammers are necessary for general work; two of these should have faces 2¼ in. long by ¾ in. wide and one a face 1⅜ in. square. In the longer ones, the length of the face of one should run parallel to the eye and in the other it should run at right angles to it. Again, the long corners of both should be rounded off to a radius of 3-16 in. The square set hammer should have its corners but slightly rounded as in the flatter. Sets, gouges and punches must be made to suit the work as required.

**Tool Material and Temper.**

Swages, fullers, flatters and punches should be made of steel, having a carbon content of .60; sets and other cutting tools of .75 carbon steel.

It will be found that tools such as swages and flatters will give better satisfaction and last far longer if they are tempered both on the heads and faces. When hardening the face of a swage or flatter, it should be quenched under a water tap or faucet; allowing the stream to flow directly on the centre of the face until cold. The temper should then be drawn till the centre comes to a brown and the edges a blue

temper color. The head should next be hardened and the temper afterwards let down to a dark blue. Tool heads tempered like this will stand much hard work without cracking or bruising.

**Working Tools—Tongs.**

Tongs form a very important part of blacksmiths' tools. If he does not have tongs which will hold his work firmly, it is impossible for him to do a good job. There are several varieties of tongs, each adapted for a special purpose and each having a distinctive name. Those made to hold flat bar stock are called "flat bitts," those for holding round stock "hollow bitts." A pair of flat bitt tongs made to hold very thin stock are sometimes called "close bitts." Flat bitts made to hold large stock have lips on one jaw which grip the sides of the bar and prevent it moving sideways; these are called "box bitts." Tongs made for holding headed work, such as locomotive drawbar pins, are bowed outwards between the jaw and the joint, these are called "goose neck" tongs. There are also special tongs used for holding deep collars while being swaged on the beckhorn; these are flat bitt tongs with the jaws bent downwards at right angles and are known as "duck bitts." A pair of tongs very useful at the forge are the "dandies" or "pliers." These have very long narrow jaws, meeting close at the points and having two or more goose necks or corrugations in the jaws between the nose and the joint. They are used to pick up small objects which are too hot for the bare hand—bits of scrap, drifts, devils, etc. They should always be kept at the back of the anvil with the "back" hammer, as they are essentially a helper's tool.

Care must be taken in making tongs that they are well proportioned to the size of the stock they are intended to hold. The joint should be forged without any sharp entering corners and free from "cold shutts." The jaws or "bitts" should taper from the nose to the joint, and the handles or "reins" from the joint to the tips. In making tongs, it is much better to forge the rein in one piece with the bitt than to forge the bitt separately and then weld on the rein. Flat bitts should have a small V-shaped impression running the length of the bitts; they can then be used for holding small square or round stock. Hollow bitts should be made with V-shaped bitts in preference to circular ones; they will grip round stock better and can also be used for square bars.

**Flat Bitt Proportions.**

The following are the correct proportions for a pair of flat bitts to hold 1 in. stock: Diameter of joint, 1¼ in.; thickness of bitt at joint, ¾ in.; thickness of bitt at nose, ½ in.; width of bitt, 1⅛ in.; depth of V, 3-16 in.; length of bitt from centre of joint, 3¼ in.; length of rein from centre of joint, 22 in.; depth of rein at joint, ⅞ in.; width of rein at joint, 9-16 in.; diameter of rein at tip, ½ in.; diameter of joint rivet, 1½ in.

In order to hold the tongs firmly onto the work, the ends of the reins should be pressed firmly together with the hands and a small link, or "coupling" as it is sometimes called, should be then passed over the tips and pressed up toward the joint; this binds the reins closely together and, of course, tightens the grip of the tips in proportion.

## BUSINESS IDEALS.

BUSINESS ideals must be considered as influencing factors in the work of the world. These ideals are as wide as they are varied. Money-gathering is one (it is of the common or garden variety); contributing to the work of the world's industrial development is another; materially aiding one's fellowman is a third, and—well, there are many others! What is yours? Ask yourself and answer honestly. Will the reward compensate you? If you feel that, even should you chance to be successful at the present time, or if your success is still to come—if you feel that the reward is, or will be unsatisfactory, then your business ideal is wrong—and you had better change it. Are you seeking comfort and ease, a cessation of active work? Don't do that! To stop work as long as you are able to continue your task is a grave mistake. Are you aiming to achieve success, so that it will enable you to benefit others? That's better, for it gives you a business ideal that is worth while. How many are included by the way, among those others? Are there only a few of those near and dear to you? Then widen the circle, for there are many—many, indeed, staggering by the wayside, weak from the want of encouragement, rather than from want of food—thirsty for help—but for help of the right kind. There are very few, indeed, who want charity—if they can get what they want in the right way. Give it to them in the right way. Don't pauperize, but "father them." Don't preach, but practice. Many of the things you can buy with money are valueless. Vice versa many of greatest value are not purchasable with all the wealth of Christendom—yet some of them can be obtained for the mere taking—if you are entitled to them—or if Life feels that you should be rewarded by them.

Certainly the street car is uncomfortably crowded, but does that give you an excuse for scowling at some poor and equally tired fellow-traveller who, hastening home to those who may be waiting for him, has reduced the amount of your standing room by one-half, because he must get on board to save five minutes that may be more precious to him than to you! Is your fellow worker uncivil? Bear with him. The high cost of living may have affected him more than it does you! Perhaps a word from you will help. Why do you withhold it? Bring in some business ideals! Civility is a good one—set the example.

Is he worrying you for that check to settle the account you owe him? Wait a moment—perhaps somebody is worrying him for money—just as you are worrying some one else. Help him if you can by paying promptly. If you can't, tell him so, and explain honestly that "collections are slow" and prove it to him if you can do so without a breach of business confidence and ethics. Did that telephone girl get the wrong number? "Stupid!" you say; but did you ever visit "Central" and see the strain to which she is subjected? Do you think you could do the work and not make a single mistake? By the way do you ever make a mistake? Don't swear at her—fortunately the telephone company won't let you repeat the offence—don't swear, but wait a moment, with a little patience. A succeeding second may find you closing that deal with the party you want.

Business ideals! They can be applied to each and every phase of life—if you know how to apply them. If you don't know how, try and learn. It's worth the effort. Busines ideals! They mean not alone success, but happiness as well.—Nat. Commercial.

## DOMINION IRON AND STEEL CO.

Mr. Arthur P. Scott has been appointed superintendent in charge of the steel department of the Dominion Iron & Steel Co., at Sydney, C.B. Mr. Scott entered upon his duties on March 31. The new superintendent has been connected with the Steel Co. for a number of years; having held the position of chief chemist until 1908, when he resigned and went to the Alleghany Steel Co. He returned last November to undertake the supervision of the metallurgical department. Mr. Scott is a son of Rev. Dr. Scott, of Montreal, editor of the Presbyterian Record, and a native of Nova Scotia.

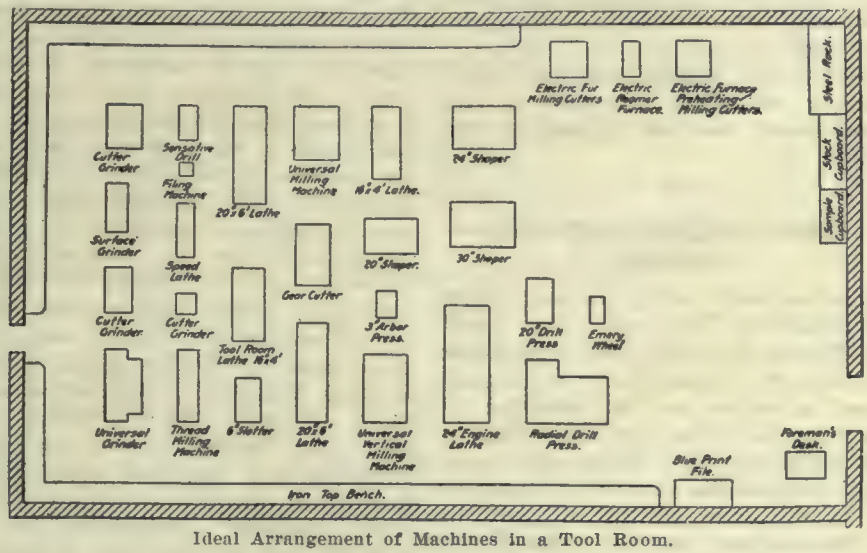
The new general office building of the Steel Co. at Sydney is about completed, and the departments which have been located in office buildings in various parts of the city are being moved there. The offices are said to be among the finest on the continent.

## RAILWAY TOOL ROOM EQUIPMENT.

By B. Henrikson.

THE question of the proper equipment for a railway tool room is determined by the special conditions of every railway shop. The number of engines to be repaired, the kind of tools and the extent of work done are factors to be considered in equipping a tool room. The ideal tool room should be so located, so equipped, so organized and so managed as to give the quickest and best repairs to broken shop tools, and the most efficient work in the manufacture of new tools, dies and special machine parts.

The tool room of a large locomotive repair shop has two functions: (1) the distribution and proper care of small tools for the daily use of shop men; (2) the repair of machine parts, special tools such as pneumatic motors, hammers, etc., the manufacture of dies and new and special tools.




Ideal Arrangement of Machines in a Tool Room.

The proper location of the distribution room is in the centre of the main shop, at a point convenient to both machine and erecting shops. The size of this room is determined by the number of tools required for the monthly engine output. The tool racks are so arranged as to give the greatest accessibility to tools; pigeon holes and pockets are plainly indexed and of such number as to accommodate every tool. An iron covered counter circumscribes the racks and is protected on the outside by a high steel grating. Openings of ample size for handling shop tools are provided in the gratings at points opposite tools receiving the greatest use. For instance, there is a window opposite taps, drills and reamers; another opposite dies, wrenches, etc.; another opposite air motors and the heavier tools. Such an arrangement greatly facilitates the quick handling.

The stock of taps, drills, reamers, etc., should be of such size that the breaking of a few of the same dimension does not necessitate the holding up of shop work. These damaged tools should be repaired at once and placed in their proper rack. In the average size shop there is work enough in the grinding of small tools to require continuous attention of one man and the employment of such a man is economy. The distribution room should be equipped with a twist drill grinder, a reamer grinder, an efficient grinder for lathe and planer tools, and a grinder with two 12-inch wheels for general work.

The second function of the tool room, the repair of machine parts and the manufacture of new tools, dies, etc., is of such importance as to require an especially equipped room. This room should be located away from the noises of the erecting and machine shops in a building annexed to the machine shop. This location prevents night men from trespassing in the search of tools, and the consequent misplacing of important work. It also provides a quiet place for the careful and painstaking labor of die and tool makers. The room should be constructed to give a maximum amount of light and air. The roof lighting system with prismatic glass windows facing the north is an excellent lighting method, and together with wall windows make the tool room especially well lighted.

### Machine Arrangement.

The machine arrangement in the ideal tool room is shown in the accompanying sketch and consist of the following tools:

1—24-inch lathe.
2—20-inch lathes.
2—16-inch special tool room lathes equipped with taper attachments.
1—Speed lathe, 12-inch swing, 5-inch bed.
1—Milling machine.
1—Universal gear cutting machine capable of cutting spiral and bevel gears.
1—48-inch Radial drill press.
1—20-inch power feed drill press.
1—Sensitive drill for work up to ½ inch.
1—Vertical milling machine.
1—Tap milling machine with automatic cutter grinders.
1—42-inch Universal grinding machine.
1—Universal cutter grinder.
1—Grinder for two wheels 16 inches diameter.
1—Up-to-date filing machine.
1—6-inch slotter for die work.
1—30-inch shaper.
1—24-inch shaper.
1—20-inch shaper.
1—Cutting-off saw for cutting up stock.
1—Electric centre grinder.
1—Portable floor jib crane to handle heavy work at machines.
1—3-inch Arbor press.
1—Electric furnace for hardening high speed reamers.
1—Electric furnace for hardening high speed milling cutters.
1—Electric furnace for pre-heating high speed milling cutters.
1—Full set B. & S. plug and collar gauges.
1—24-inch steel gear rule.
1—96-inch B. & S. standard steel rule.
1—12-inch Vernier calipers.
1—24-inch hardened cast steel try square.

In the grouping of tools it has been found that where grinders have been placed near lathes and other machines having exposed wearing surfaces, that the emery dust has caused increased wear on these parts. It is well to separate machines that have such surfaces or apply suction fans to emery wheels and remove the flying emery.

The machine tools should all be individually motor driven. This system eliminates the cumbersome shafts and belts and unnecessary wear when the machines are not in operation. It prevents the possible "tying up" of the whole tool room when a main belt breaks, and eliminates the necessity of running the whole shop when the use of only one machine is desired. The direct motor drive allows an absolute independent location of every machine, which is impractical in the belt driven shop where the best belt arrangement often determines the location of tools.

Benches with iron tops, drawers and locks should be provided for the men; and swivel jaw vises should be placed at convenient places on the benches. Cupboards for sample work, and for filing of blueprints should be provided at convenient places. The ideal tool room is provided with a suitable rack for a

light stock of annealed tool steel. Pin racks placed on the walls for milling cutters and emery wheels are very necessary. Cupboards for the proper storing of finished tools should also be provided.

It is obvious that the quicker a broken engine is repaired, the greater is the earning capacity of a railroad. Engine repairs must be made with tools; the tools must be in good condition, ready when wanted and quickly despatched to where they are required. It follows that the tool department of the locomotive repair shop is an important factor on a railroad. This importance demands efficiency; and the tool department, separated into two distinct parts and equipped as described above will meet this demand. — Ideal Power.

## PAY UP.

THE man who can pay his bills and doesn't is one of the public enemies who are responsible for the slow recovery of business. He cripples industry, restrains trade and creates a long line of debtors who cannot pay. He is a brake upon prosperity, a drag upon humanity. He has been a deterrent factor in business the past five years, ranking in depressive effect next to the financial flurry of 1907. The habit of deferring payment, contracted anew in 1907, has become chronic with individuals, firms and corporations, and has served to harass business to an extent appreciable only to the bankers who carry the accounts of the retailers and smaller manufacturers. By withholding payment of one bill a procession of difficulties is formed. A hoards his cash and embarrasses B, who has to put off C, and D is pressed to the wall. The chain of evil, started by the prosperous, reaches down through the ranks of industry, commerce and labor, cramping enterprise, confining trade and galling most of all the men at the bottom of the business structure.

This survival of panic times has become engrafted upon our business system to such an extent that in some circles the pride in being considered "prompt pay" is now regarded as old-fashioned, and skill in putting off one's obligations has come to be reckoned a desirable acquirement.

The business situation to-day, however, seriously demands the classing of the deliberate slow-payer with the cheat. His reformation would free the involuntary slow-payer from a plight that is none of his choosing, and would make the wheels of business hum with prosperity.

You who can, pay up. Then those who now can't pay will be able to do so. Money will flow faster through the arteries of the country's life, and all the people will be benefited.—N.Y. Evening Mail.

## THE CRAZE FOR HIGH SPEED.

Inventive genius saves time with a spoon for people who waste time with a shovel. For every ten minutes that labor-saving machinery "economizes" in the construction of a modern building, an hour is wasted by the sightseers who stand idle on the street and watch the machinery at its labor-saving work.

The telephone is a real blessing that degenerates into the curse of unnecessary talk. The typewriter becomes an agency for the multiplication of useless letters. The theory that this generation's time is precious, and there is not a minute to waste, is one of the superstitions of a deluded people who save hours on a journey in order that they may squander days at the journey's end.

Months for pleasure, but not a minute for safety, is the motto of this speed-crazed day and generation.—To. Tm.

## OCEAN WRECKS AND RAIL WRECKS.

Captain Smith, of the Titanic, cannot be blamed for the disaster that befell the Titanic any more than the engineer can be held responsible for the terrific speed at which he was compelled to run, but which broke the heavy modern rail under his train. Both acted under rigid instructions from their superiors to "smash all records."

There is one sure and certain way to escape such disasters, and that is to avoid record-breaking steamships and railroad trains. Many busy men of affairs in the middle West board the slower but safer trains when traveling, and their number is being constantly added to. When the American traveling public reaches the same conclusion that it would rather arrive safely at its destination than merely "clip off" a few minutes here and there; only to sit around and boast of it after getting there; in other words, when the traveling public prefers safety to boasting, when it has learned to use the minutes of the day for actually useful purposes rather than to boast of its sham and pretence of "rushing"; then traveling on land and sea will be far safer. There will be little heard of "faulty steel."

Rail breakages and shipwrecks have much in common. Both are sacrifices to the Moloch, speed. Both are the legitimate fruit of the modern curse: "Hurry up!"—D. I. T. Review.

## PRODUCTION AND WAGES.

I APPRECIATE the fact that there is a good deal of opposition to be met in labor unions, and that the leaders of these bodies are standing, as usual, in their own light. The effort of labor unions has always been to increase wages and curtail production, in the belief that this policy was bound to improve the condition of labor, but regardless of the fact that the wage-earners of the world are its principal consumers, and that limitation of output increases the cost of everything they buy, and multiplies the privations they have to bear.

One is reminded of Carlyle's observation on the vast numbers of human beings in this world, "mostly fools," and without doubt a campaign of education is needed to illuminate their real interests and show clearly that the greater the products of labor the greater the wealth to be divided and the greater the workman's share in it, because he always has the lion's share, notwithstanding the unequal distribution among the rank and file in the whole industrial army. An increase in wages is obviously a good thing for the wage earner, at the expense of the consumer; but when the increase in wages becomes general, the cost of living naturally rises in the same proportion, and nobody is economically any better off. When production however, increases along with wages, the cost of living is held down and labor is more prosperous. So also when more is produced for the same wages, the cost of living drops, to the manifest advantage of all labor. The real interest of labor lies, therefore, in the maximum production and the most advantageous distribution of wealth to the proletariat.

The maximum production can be brought about, however, only by unequal distribution, which supplies the necessary incentive to bring out the best effort of the individual worker in every form of active business life. The proletariat is too prone to think that he is the whole thing in the production of wealth, whereas in many lines of trade it costs more to sell than to produce, and still more in interest on the capital invested, which is just as necessary as labor itself. It cannot be denied that good wages help consumption far more than excessive profits in a few hands, and, to maintain a steady market and a good demand for all the products of industry, let us hope that capitalists and the captains of industry will eventually realize that it pays to be liberal to the lower ranks of labor, and so build up a higher type of citizenship, which will produce and consume a large portion of the good things of life. To this end scientific management is moving, and motion study, as a part of it, is helping the good work along.—Wilfred Lewis, in Engineering, Jan. 5, 1912.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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Vol. VIII. MAY, 1912 No. 5


### PLANT OF HARLAND & WOLFF.

IN view of the widespread interest aroused by the recent foundering of the steamship Titanic with over 1600 souls on board, we have given on pages 153-4-5 of this issue a brief illustrated description of prominent machine tool and other equipment features of the world famous shipbuilding and marine engineering plant of Harland & Wolff, Belfast, Ireland, the designers and builders of the Titanic and her sister ship, the Olympic.

### THE TITANIC DISASTER.

CANADA, in common with the Motherland, the United States and other nations of the world, has been hard hit by the disaster, which overtook the magnificent and luxuriously appointed White Star Line steamship Titanic in mid-Atlantic on the early morning of April 15. Men prominent in various fields of enterprise in this Dominion, met what we might be disposed to claim an untimely end, yet, on reflection, it surely may not have been so, else that heroism which they displayed would have been shorn of its sublime naturalness and grace.

Not only is a world of sympathy being tendered the bereaved relatives of all who went calmly down to death, but, in addition, there is already being prepared the foundations for that undying monument to brave men and women, which will make our means of transportation not merely conveyances of more or less luxury, but at the same time veritable Museums of Safety. The big ship was never claimed by responsible people to be unsinkable, but we are afraid that the eye, the appetite and the long purse were more prominent in the catering arrangements than was the provision for the conservation of human life. A few months ago, we directed attention in these columns to the efforts being put forth, concerning this latter feature in large manufacturing industries throughout the civilized world, and while, as a result of this tragedy, we look for the greatest developments in the conservation of life and property taking place in matters marine, there will undoubtedly also be given considerable impetus to the propagation of a like result on land.

### SYSTEMS OF SHOP MANAGEMENT.

RECENTLY the special committee of the U.S. House of Representatives appointed to investigate the "Taylor and other systems of shop management," submitted its report at Washington. Included within the scope of the work, the committee was empowered and expected to determine the applicability of any or all of the "systems" to Government shops, their effect on the health and pay of the employes and such other points as might be noted as the result of the installation and operation of a particular scheme. While attention was directed to different systems which were found installed in a more or less limited number of manufacturing establishments, particular attention was directed to that known as the "Taylor system," because of the fact that it had already been introduced into a few Government plants and was under consideration for others.

The net result of the committee's investigation is that, while a large amount of good has been accomplished in working out the details of "scientific methods of shop management," neither Mr. Taylor nor anyone else has presented a system so complete and perfect as to justify a recommendation that it be imposed in its entirety in any Government shop.

The report is remarkable for its thoroughness of insight into the economics of the various questions and contingencies involved, and bristles with plain, simple, blunt, unvarnished statements of considerations to be accounted. It is clearly indicated that the employe be recognized as a man and that he be treated as such. It is also made impressive that the introduction of any efficiency scheme, be one of evolution instead of revolution, and that mutual conference and consent, the parents of beneficial results, are at all times preferable to the imposition of "efficiency" ideas on an unprepared and, therefore, naturally unwilling working force. Efficiency may not be practised at the cost of men, women and children who labor; rather should they be the prime beneficaries.

The report recognizes the distinction between a man and a machine; the latter having neither life, brain, sentiment or place in our social order, and in this reference says, that "he would be less than a man did he not resent the introduction of any system which deals with him in the same way as a beast of burden or an inanimate machine."

We have only referred to those features in the report around which more or less discussion has raged; believing that a due appreciation of the importance of these as set forth in this committee's able and timely report, will accelerate, more than anything has yet done, an unsuspicious acquiescence on the part of those who serve, and a reasonable considerateness on the part of those who direct.

Even if it accomplishes nothing else, it should effectually quench the "efficiency engineer fever" and stop the penning of the more or less brainless effusions which have appeared from time to time by people who could not do a day's work without leaning on somebody else or helping themselves from what somebody else already owns.

# Factory Lighting

THE need for an improved artificial lighting in factories and workshops has previously been emphasized in our columns. It would seem likely that factory owners will be forced by legislation to improve existing means and methods of lighting their workshops. That the direct physiological effect of good lighting is an improvement in the quality and quantity of the output of the various operatives is fairly obvious, but there is another very serious aspect of the case which factory owners would do well to consider. Inefficiency and insufficient lighting is the cause of a large number of accidents; this being borne out in statistics published by Government departments, and further substantiated by the opinions of Insurance companies. In fact one large company places poor lighting first amongst the general causes of accidents.

It is not a very difficult matter to arrange a successful scheme of workshop lighting. All that is required is the application of a few common-sense principles and to bear in mind the fact that the light should fall upon the object and not upon the eye; at the same time securing even illumination with freedom from heavy shadows and streakiness. There are now available a large number of specially designed reflectors and fittings for interior lighting which distribute the light in a certain definite manner; by spacing them properly it is possible to carry out the installation so that a successful lighting scheme will result. This need not entail any extra cost over the ordinary installation in which enamelled iron shades of the common pattern are used in an indiscriminate manner. Apparently the sole virtue of this class of shade is its cheapness; it does not shield the eye from the bright filament of the lamp, and owing to variations in the manufacture, no two enamelled iron shades will be found to distribute the light in an exactly similar manner.

Good lighting means cheap lighting. There should not be and need not be any waste. As regards the quantity of light, this depends entirely upon the class of work which is being carried out in the factory. Some trades, for example lithographing, engraving, etc., require a large amount of light, whereas in foundries it is much smaller. Expressing it on a per capita basis, even if so large a quantity of light as 100 c.p. per man is allowed, this at 4 cents per unit will only entail a cost of about ½ cent per hour. In the case of a skilled workman, earning say 25 cents per hour, it needs very little improvement in his output and quality of work for this cost to be recovered.

**Considerations to be Accounted.**

There are two considerations to be dealt with in all factories and workshops. First, with reference to the question of general lighting in shops, and secondly, the provision of local lighting for machines, lathes, tools, etc. In other cases, the point to be remembered is that the cost of carrying out the lighting scheme properly is insignificant, with the risk that is run of accidents, which, as has been mentioned, are largely the outcome of inefficient lighting. There is also the danger of the work being spoilt through inefficient illumination. Special trades and situations each require individual consideration. Some trades call for good general illumination only, others require in addition to general lighting, local lighting.

**Illuminating Mediums.**

The general illumination can be effected in three ways. (1)—by arc lamps; (2)—by mercury vapor lamps; (3)—by incandescent lamps. The first method is very suitable for large areas where the lamps can be installed high up. In general there are three types of arc lamps to be considered. (1)—Flame lamps burning mineralized carbons; (2)—enclosed lamps burning pure carbons; (3)—open lamps burning pure carbons. The uses of each may be summarized generally as follows:—

Flame lamps for very large interiors or for exteriors of shops where great illumination is required from an advertising standpoint. Enclosed lamps for small engineering shops and foundries where considerable intensity of the light is not required to be very great and the question of maintenance, the re-trimming of the carbons, is a difficulty.

Open type lamps have been largely displaced by the flame arc, but they may be used for large interiors where the ceiling is lofty and the walls are light colored and therefore of good reflecting power.

Mercury vapor lamps can be used for general lighting with excellent results wherever the color of the light is not objectionable. These lamps give, of course, a peculiar bluish white light. The principle upon which the lamp works is such that the light is diffused and softened to a much greater extent than with any other form of artificial light, although the nature of the light is such as to be unsuitable for color matching. They are exceedingly cheap to run, but somewhat expensive in first cost. A c.p. of 1,200 can be obtained from these lamps with energy at 6 cents per unit, at a cost slightly exceeding 2 cents per hour.

As a comparison, it may be mentioned that this is approximately 25 per cent. less than the cost with an open type flame arc lamp, but it must be remembered that with the mercury vapor lamp there is no additional expense to be added through the cost due to the labor required for re-carboning. Incandescent metallic filament lamps, because of their simplicity and the nature of the light, will probably be found most suitable when ordinary conditions only have to be considered. With their cost for current taken into consideration, the renewal of the lamps would be approximately 50 per cent. more than with a mercury vapor lamp.

**Fitings and Reflectors.**

The main factor in successful or otherwise lighting by incandescent lamps is the class of fitting or reflector with which they are used. In addition they should be properly spaced. The reflector has a most important effect upon the general illumination, and if the case of one particular pattern is considered it will perhaps lead to an understanding of the results obtained by a reflector when used in conjunction with an incandescent lamp.

With different shapes of reflectors the distribution of light can be altered according to varying requirements. For example, whilst one particular type of reflector would increase the candle power in a downward direction, directly below the pip of the lamp, another type of reflector is so arranged that the light is thrown in a sideways direction to the greatest extent, thus distributing the light over a much larger area. It is obvious that these various types have different applications which vary according to whether a diffused or an intense bright light in a certain direction is required; say for example, over a printing machine.—Electrics.

## FRASER & CHALMERS, LTD.

Fraser-Chalmers, Ltd., of London, England, previously represented in Canada by Mussens, Ltd., have opened a Canadian branch office at 4 Phillips Place, Montreal. Arthur H. Sancton, formerly their engineer in Canada, has been appointed manager, and important additions have been made to the Canadian engineering staff.

The firm manufacture an extensive line of mining and power machinery, including high power gas engines, steam turbines, air compressors, steam and electric winding engines. Stumpf uniflow engines, conveyors and transporters, smelting equipment, concentrating plants cyanide plants, stamp mills and crushing machinery. They are the sole manufacturers of the Bettington Dust Fuel Boiler. This is a departure in boiler design which has been extremely well received.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

## Spur Gear Features

By G. D. Mills.

FIG 4 contains the method by which the true involute tooth curve is constructed. The points which define this curve are obtained by drawing a series of lines at right angles to the radiating lines from their point of intersection with the base circle of the involute curve, and length to be laid off on each is the circular distance measured on the base circle from the radiating line of flank of tooth to the commencing point. A very common mistake in forming this curve is to lay off the chordal distance. This robs the side of the tooth of a small portion of metal and also of its correct outline.

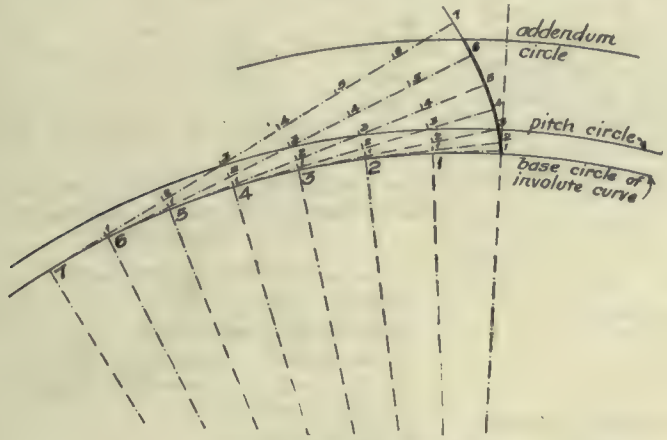



Fig. 4—Spur Gear Features.

The quarter circumference of the base circle should be divided into an equal number of parts and the greater the number the more correct will be the profile. The length of quarter circumference can be determined by multiplying the diameter of base circle by 3.1416 and dividing by 4, which length may be marked on a straight line and divided in the same number of parts as we have divided the quarter circle into. We thus determine on a straight line, the circular length of each division. This operation will not be necessary for normal wheels, as the difference will be found too small to warrant it; but in the smaller wheels it will be found necessary if a true profile be desired. The profiles of all gear teeth vary with every change made in the diameter of the base circle of the curve; and if the teeth are formed correctly they will interchange and roll off smoothly without digging into the flanks of the engaging wheel, a trouble largely due to defective profiles.

**Duplication of Involute Curve.**

Fig. 5 contains a true involute profile of a gear tooth, and a method by which we may duplicate the curve, in drawing the remaining teeth in the wheel. After the pitch circle and addendum circle have been described, and the angle of pressure defined by the line of pressure (a b), which in 14½ degrees obliquity will be 75½ degrees, we may draw the base circle of the involute curve tangent to (a b), or the radius of base circle can be calculated by multiplying the radius of pitch circle by .9681, from Fig. 3. The involute curve is then constructed as in Fig. 4, and the average inclination of the profile thus obtained, between points (c and d) is determined by means of circular arcs and the oblique line (e f), on which we may obtain a radius by trial which will fit the profile. Through the point so found for this radius on the line (e f), a circle should be described, which is the circle for centres of tooth arcs for the remaining profiles. If we hold the marking leg of the compasses on the pitch circle at the points defining the width of each tooth, and the other leg on the circle for centres of tooth arcs, the profile can be duplicated for the remaining teeth in the wheel. The fillet in the corners is formed by a radius which is equal to 1-7 of the clear distance between teeth on the addendum circle.

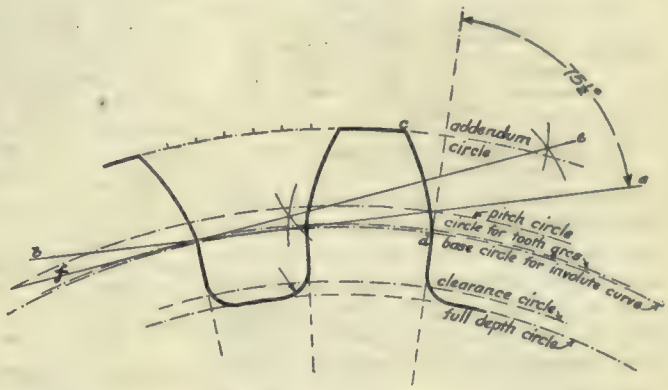



Fig. 5—Spur Gear Features.

**Method II, Involute Tooth Construction.**

Fig. 6 contains another method by which involute teeth may be constructed

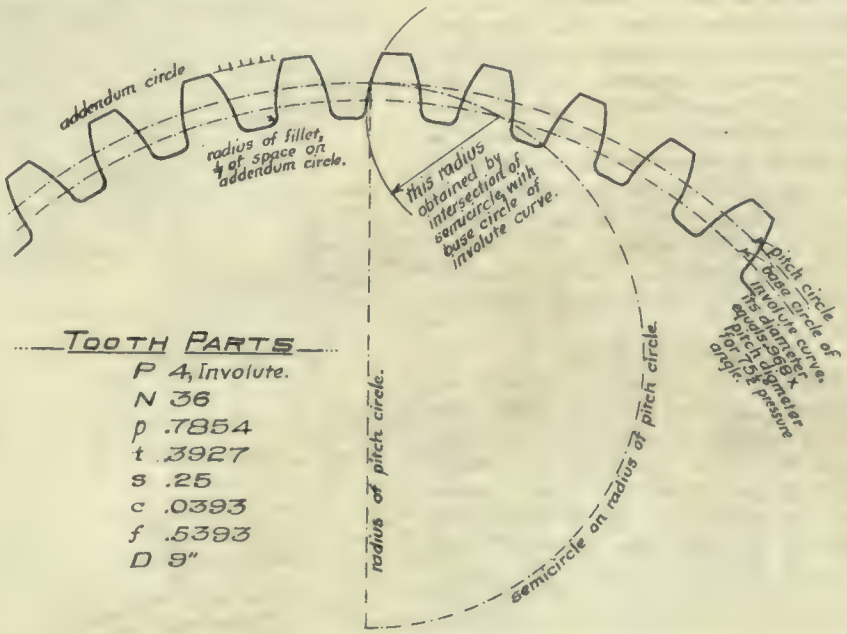

addendum circle
radius of fillet, ¼ of space on addendum circle.
this radius obtained by intersection of semicircle with base circle of involute curve.
pitch circle
base circle of involute curve. its diameter equals 9.968 for pitch diameter for 75½° pressure angle.
radius of pitch circle.
semicircle on radius of pitch circle.
TOOTH PARTS
P 4, Involute.
N 36
p .7854
t .3927
s .25
c .0393
f .5393
D 9"

Fig. 6—Spur Gear Features.

and the profile thus obtained corresponds very closely with the true involute curve in normal wheels, while there is a noticeable difference in the coarser pitches of small wheels. This method is extensively used in the manufacture of involute gears, owing, perhaps, to the fact that it requires less time to construct than first profile. The lines of Fig. 6 are marked so that its construction is made plain. It will be noticed that the radius by which the curve is formed is equal to the length (c,d) of the triangle (a, c, d) in Fig. 3, and that the circle for centres of tooth arcs in Fig. 6 is the base circle of the involute curve. It will be found,

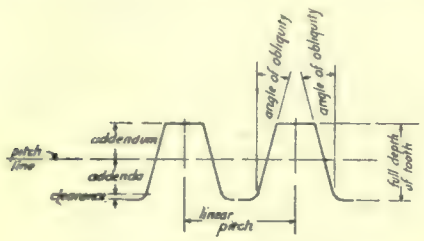



Fig. 7—Spur Gear Features.

however, that the radius by which the true profile is duplicated can rarely be made to fit the curve and fall on the base circle, although it will approach close to it, as in Fig. 5. The radius of fillet in corners is equal to 1-7 of the clear distance between teeth on addendum circle.

Fig. 7 contains a diagram of two involute rack teeth. The pitch line and linear pitch corresponds to the pitch circle and circular pitch in spur gear wheels. The width of tooth is laid off on the pitch line, equal to one-half the linear pitch, and the other tooth parts as in wheels. The meaning of the angle of obliquity is exemplified in involute rack teeth, since the sides of the teeth are straight lines inclined at an angle with the perpendicular; being the angle of obliquity of the engaging wheel. The only operation necessary to draw the teeth is to lay off the angle of obliquity with a protractor on each side of a line which is perpendicular to the pitch line, and parallel these lines through the points defining the width of teeth on pitch line. The radius of fillet bottom of tooth is equal to 1-7 of the clear distance between teeth on the addendum line.

### Cycloidal Racks.

The sides of cycloidal rack teeth are composed of two curves, which are known as parts of a cycloid. The operation by which the curves are obtained is similar to that for wheels, except that the generating circle is rolled both sides of the pitch line instead of both sides of the pitch circle. The curves thus obtained are not pronounced, and the hurry-up method is frequently in evidence, when we see the sides of cycloidal rack teeth formed with straight lines, as in involute racks.

### Calipering.

The width of each tooth in a wheel should be tested with a tooth gauge, or an adjustable caliper. In the illustration Fig. 8 is shown a gear tooth and part of a caliper. The jaws of the caliper are about the tooth, while the depth gauge rests on top of it. In order to caliper the width of the tooth on the pitch circle, we shall have to set the jaws of the instrument to a distance equal to the chordal length (b e d) which is less than half the circular pitch (or b c d). It will also be necessary to increase the length of the addendum (c f) and make it equal to (e f); adding the distance (e c) to obtain the correct length to set the depth gauge of the caliper. Both lengths may be readily calculated; if we consider the wheel a regular polygon and the teeth and spaces its sides. The angle which each tooth subtends at the centre of wheel is therefore

$$\frac{360 \text{ degs.}}{2 \times N}$$

and the half angle or angle

$$0 = \frac{360 \text{ degs.}}{4 \times N} = \frac{90 \text{ degs.}}{N},$$

in which N equals the number of teeth.

In the right-angled triangle (a e b) the radius of wheel (a b) or one-half the pitch diameter × sine 0 equals the half chord (b e) and, therefore, the pitch diameter × sine 0 = twice (b e) or the chordal width of tooth on the pitch circle (b e d). The length (e c) which must be added to the addendum (c f) is the versine of the arc (b c) and the increased length (e f) is, therefore [R × (1—cosine 0)] + addendum, in which R = radius of pitch

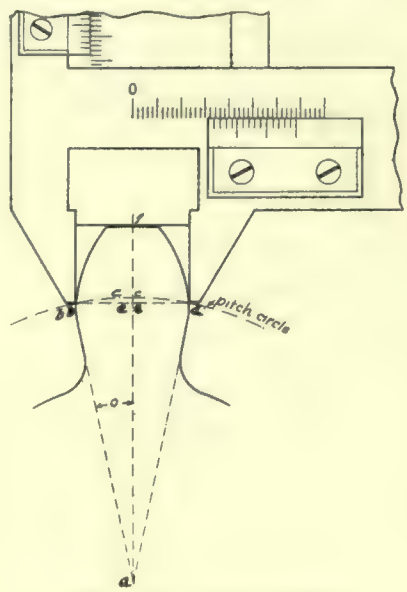



Fig. 8—Spur Gear Features.

circle (a b). The length (e c) is also the height of the segment (b, c, d, e), and may be calculated by the formula for heighths of segments. The increased length, e f by geometry, therefore equals: $[-\sqrt{R^2 (R \times \sin. 0)^2}] +$ addendum, and R × sin. 0 equals the half chord (b e).

### Caliper Formulae.

The following explains the application of the formulae. The caliper width and caliper depth of the tooth may both be determined from sine 0 with the formulae. In the example given previously in this article, Fig. 2, the half angle of tooth for the gear =

$$\frac{90 \text{ deg.}}{36} = 2\tfrac{1}{2} \text{ or } 2 \text{ deg—}30',$$

and the half angle of tooth for the pinion =

$$\frac{90 \text{ degs.}}{12} = 7\tfrac{1}{2} \text{ degs. or } 7 \text{ degs} - 30'.$$

By referring to a table of sines, the sine of each angle can be ascertained.

CALLIPER FORMULAE.

$0 = \frac{1}{2}$ angle of tooth $= \frac{90°}{N}$

Calliper Width of tooth $= D \times \sin. 0$

" Depth " " $= [R \times (1 - \cos 0)] + s$

" " " " $= [R - \sqrt{R^2 (R \times \sin 0)^2}] + s$

$N$ = Number of teeth

$D$ = Pitch diameter

$R$ = Radius of pitch circle

$s$ = addendum

$0 = \frac{1}{2}$ angle of tooth

The decimal part of the degrees should be reduced to minutes and seconds, if it will permit. The sine of 2 degs. — 30' is .0436, and the caliper width of tooth for gear = D × sine 0 = 9 × .0436 = .3924 inches. The sine of 7 deg.—30 is .1305 and the caliper width of tooth for pinion = 3 × .1305 = .3915 inches. The caliper depth of tooth for gear by geometry = $[R - \sqrt{R^2 (R \times \text{sine } 0)^2}] + S = [4\tfrac{1}{2} - \sqrt{4\tfrac{1}{2}^2 - 4\tfrac{1}{2} \times .0436)^2}] + .25 = (4\tfrac{1}{2} - 4.4957) + .25 = .2543$. The caliper depth of tooth for pinion $= 1\tfrac{1}{2} - \sqrt{1\tfrac{1}{2}^2 - (1\tfrac{1}{2} \times .1305)^2} + .25 = (1\tfrac{1}{2} - 1.48717) + .25 = .2628$. The operation for determining the caliper depth of tooth may be shortened by using the cosine of each angle in the table of sines, and applying the formulae [R × (1—cosine 0)]+S, by which the same results are obtained. The caliper depth of tooth for gear $= [4\tfrac{1}{2} \times (1 - .99904)] + .25 = .2543$ inch, and the caliper depth of tooth for pinion $= [1\tfrac{1}{2} \times (1 - .99144)] + .25 = .2628$ inch.

It is as important and necessary to caliper each tooth in a wheel as any other operation connected with its manufacture, but no amount of caliper-

ing will detect inequalities in spacing. Keying troubles, which are so common in all gears, may be traced mainly to defective spacing of the teeth.

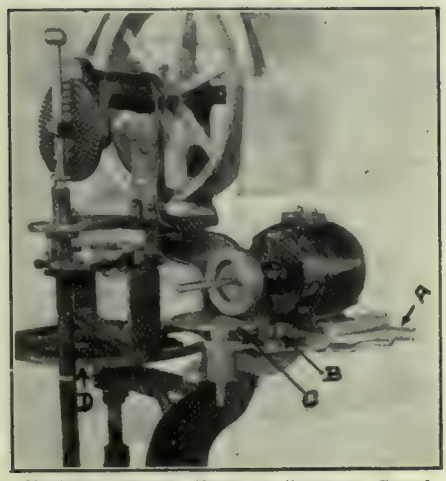
The profiles of Brown & Sharpe cycloidal gear cutters are supposed to be geometrically correct, as the profile is obtained by means of a machine known as the Odontom engine, which rolls generating circles with mechanical as well as mathematical accuracy. The profile of the cutter is that of a space between two teeth which it mills out. The number of teeth and diametral pitch determine the profile of the cutter. As the pitch diameter of the wheel varies with these two quantities, $D = \frac{N}{P}$, the difference in the profile of one diametral pitch and two numbers of teeth is well illustrated in the reduced cut, Fig. 2, previously published. The pitch is 4 diametral, and the profile of the 12-tooth pinion is noticeably different from that of the 36-tooth gear.

## VARIABLE SPEEDS FROM A CONSTANT SPEED MOTOR.

By E. W. Tate.

THE half-tone illustrates the method used to obtain variable speeds from a constant speed motor. The latter was originally placed on a bracket, similar to that shown, with a grooved pulley of two diameters on the armature spindle.

For conversion purposes, the original base was discarded and a gibbed base substituted. A leather friction and disc were used in place of the grooved pulley, and in the base was placed a gear, keyed to a vertical stem, on the opposite end of which was attached the lever (A). The gear was meshed into rack (B),




Variable Speeds From a Constant Speed Motor.

which in turn was secured to the under side of the motor. A movement forward or back of the lever (A) increased or decreased the speed of the disc (C), which transmitted power to the machine through the grooved pulley (D).

## REAMER HOLDER.

By R. G. D.

SOMETIMES, in a large factory, situations lead to interesting results in the methods used to solve different manufacturing problems. I have in mind a case which is almost universal in automatic screw machine work, the floating bushing method of holding reamers and counter bores, as illustrated in Fig. 1. It is the writer's experience that work machined in this way is apt to show large at the end; that is, the bore will be slightly larger at the commencement of the operation, due to the fact that the reamer is free to sag below the centre of the work. This causes it to "wobble" and cut large until such time as it has reached a depth sufficient to support it, when of course the trouble ceases.

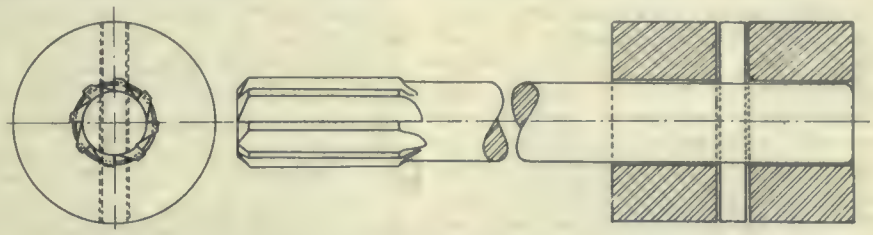


Fig. 1—Reamer Holder.

To eliminate this trouble we devised the reamer holder shown in Fig. 2, which is almost self explanatory. A, the body, is held at the turret, and centre B adjusted until it takes the thrust; the pin C simply being the driving member. The action of this tool is such that it centres itself immediately upon entering the work, as can be readily seen. It may be interesting to add that since using this device, our scrap has decreased to a very marked extent. I would say that about six months after this tool was designed, we found one almost exactly like it in "Rose's Complete Machine Shop Practice," although at the time no one knew of any such tool; all of which goes to show that there is nothing new under the sun. This is written with that idea in mind.

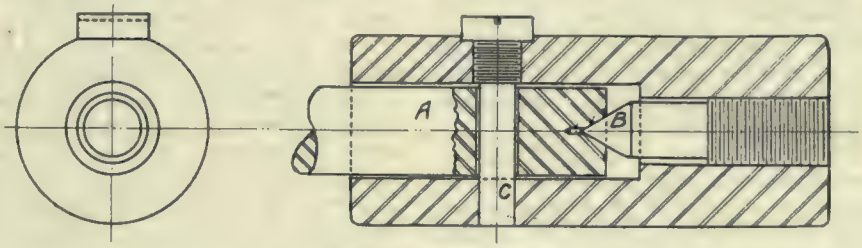


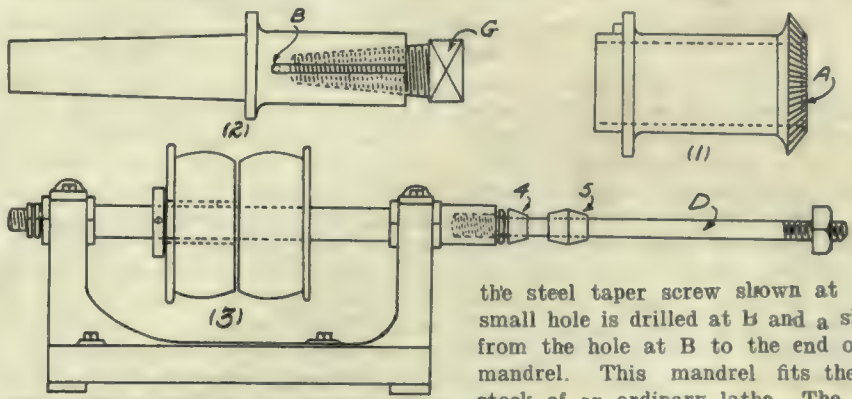

Fig. 2—Reamer Holder.

## BOBBIN WHEEL MANDREL AND POLISHING LATHE.

By G. Barrett.

THE following article will no doubt appeal to readers of Canadian Machinery, who are interested in the manufacture of bobbin wheels for textile machines. The primary operations on these bobbin wheels, namely boring and rough turning, present no great difficulties, so particular attention will be paid to the finishing methods.

No. 1 shows the wheel as it appears when fully machined. After being bored and rough turned they are very fragile, as all the scale has been removed. Thus, in driving them on and off a mandrel in the usual way, a great many are broken To reduce this, I made the mandrel shown in No. 2. It is made from tool steel and is bored, and tapped to suit the steel taper screw shown at G. A small hole is drilled at B and a slot cut from the hole at B to the end of the mandrel. This mandrel fits the headstock of an ordinary lathe. The wheels




Bobbin Wheel Mandrill and Polishing Lathe.

are placed on the mandrel in the lathe, and one turn of the screw G is sufficient to secure the bobbin wheel sufficiently for it to be skimmed up and recessed as shown at A. A great deal of time is saved at each change of wheels, because all the pounding on and off mandrels is eliminated.

Bits of cotton adhere to these wheels if they are not smooth, therefore I made a polishing lathe as shown in No. 3. Eight wheels can be polished at a time. The extended spindle D is ¼ in. diam. The wheels vary in outside diameter from 1 to 1¼ in., and to accommodate several sizes on the spindle at once, the cones shown at 4 and 5 are used. A single cone similar to 4 is first placed upon the shaft, then a wheel, then a double cone and so on, until the spindle is full. The nut is afterwards tightened and the wheels polished. The mandrel described above and also the polishing lathe are often used for collars and brushes.

## AUTOMOBILE TRANSMISSION GEAR.

By A. W. Cookson.

THE main drive gear as used on several makes of automobile transmission of the sliding gear type is shown in Fig. 1, and the method of machining it, as adopted in a prominent automobile factory, is here described.

The part, a drop forging of chrome vanadium steel, is first machined on the outside on a Lodge & Shipley manufacturing lathe with gang cutters. It is then reversed and held in the chuck by the shank, after which the large outside diameter of gear, hole (A) and relief for the coupling, are machined. It has been found that the work at this stage is accurate enough for the outside diameter of the gear, but owing to internal strains within the forging, it is not practical to finish cutting the teeth until after carbonizing, which process while relieving all the strains, generally distorts the piece. The teeth are, therefore, rough cut, leaving a small amount, about .010, on each side, to be taken out later. All the other operations are, however, done, except the grinding and keyway cut. The coupling is finished and backed off, the holes being drilled and the thread cut. The part is next carbonized, but not hardened, and returned to the gear cutter, where the teeth are finished to size. The turned surfaces (B and C) are, however, not in good shape to use for holding the gear for this final cut on the teeth. They are, therefore, rough ground, leaving a small amount for the final grinding after hardening.

It is, of course, necessary, if the complete gear is to be up to the standard required in modern automobile manufacture, that the part be held very rigid in the chuck for this final gear cutting operation. The writer designed the chuck shown in Fig. 2 to do this work. The construction is clearly shown in the sectional view and needs little explanation, other than to say it is necessary to use care in making up the chuck so that the work will be held central. In use, the gear is pushed back into the chuck uptil the face (D) strikes the flange on the spring collet. The hood (F) is then screwed up until it compresses the outer spring collet (B) on to the bearing (H), when the further movement of the hood will cause the collet and also the gear to move back into the chuck and so tighten the back collet (C) on to the other bearing (J). The collets (B and C) being independent of each other will allow for a small variation in diameter of the two bearings and still hold well, which would not be the case were one collet only used to draw on both bearing surfaces.

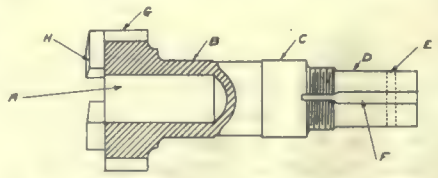



Fig. 1—Main Drive Gear, Automobile Transmission.

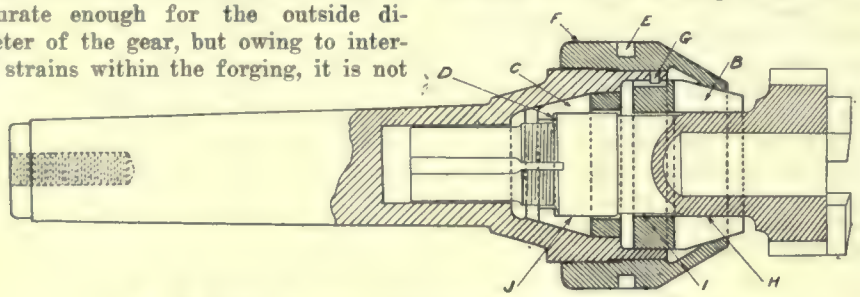



Fig. 2—Chuck for Main Drive Gear, Automobile Transmission.

A pin (G) has been provided to prevent the front collet turning, and so changing the position of the gear in the chuck, as being readily understood that the gear must be placed in proper relation to the cutter for this operation of finish cutting. The holes (E) are spanner holes for tightening the hood. The taper shank is fitted to the gear cutter spindle and is a standard B. & S. taper, but it can, of course, be fitted to any machine. It will be found that this chuck will hold well under any ordinary condition. After the last operation of gear cutting, the gears being reheated and hardened, are then ready for the final operation of grinding. The surfaces (B, C and D) are first ground, the work being held in a special chuck designed to hold the gear by the root diameter. This surface is, when using a form cutter, always concentric with the pitch diameter.

A chuck of same design as Fig. 2, but with a shank fitted to the grinder, is used to hold the gear for the operation of grinding the hold (A) and for grinding the bushing when in place. With reasonable care in keeping the chucks free from dirt and chips, the above method of machining will result in a gear that will be true to pitch and with the pitch line concentric with all the bearings; and, providing the other gears into which this part will mesh are cut with the same amount of care, will insure a silent running transmission.

## AN UNLISTED CALIPER.

By T. R.

LATHE hands at some time or other in their experience have performed work which has caused them more or less hard thinking and worry as to correctness of requirement and economy of production time. One such job may have been a casting or forging for a boiler manhole strengthening plate, which, when completed on the lathe, should have a certain definite radius. With, possibly, only a small arc of the latter turned, absolute accuracy cannot be determined unless a radius gauge be applied, and even then, much time may be lost in the process. By means of the caliper illustrated and application described, it will be found possible to produce work of such a nature both correctly and expeditiously.

Set the caliper to the amount of the radius and place tool in rest. Mark the work, by revolving in the usual manner, with a surface gauge set to height of tool point. After setting the job opposite to and at its furthest point from the tool and with the inside caliper leg at the tool point, set the outside caliper leg to the mark made by the surface gauge.

"Men who hold office must work hard!" Whether in the service of the State or of industry, it, furthermore, means that one must devote a full measure of work and thought to the duty owed to the safety and welfare of those who are dependent upon us for their wages.—Ex.

# DEVELOPMENTS IN MACHINERY

## A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

### SPECIAL PAPER BAG MACHINE.

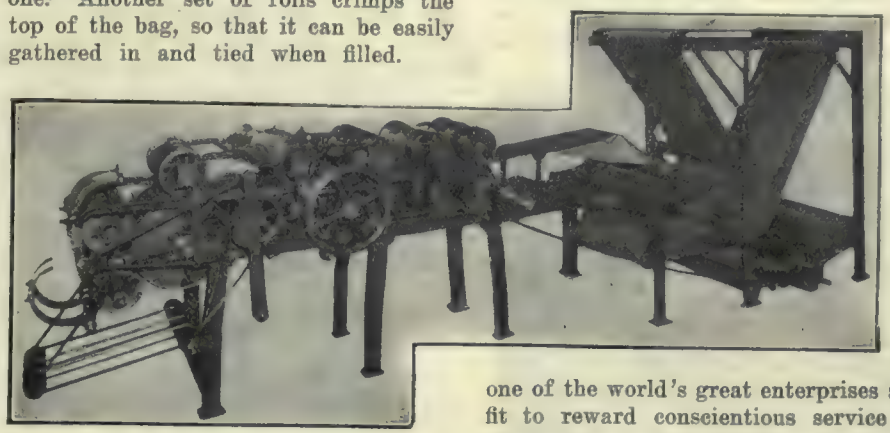
MACHINERY is being employed in such a multitude of directions to replace hand labor, that there seems no limit to its adaptability. Special machines have become everyday occurrences, and as a consequence in a great many cases they command attention but for a brief period.

Recently, the Holden-Morgan Machinery Co., Pearl Street, Toronto, built for the Standard Chemical Co., a machine which takes a roll of paper of certain width, passes it through a small printing press, cuts, applies paste, and folds the paper; finally transforming the latter into a bag all ready for use. The very ingenuity of the machine, coupled with a neat and clean cut appearance, causes one to pause in admiration. The apparatus is now installed in Montreal, and is reported to be doing even more work than that for which it was designed.

The roll of paper is placed on the spindle provided for same; the first operation thereafter being that of printing the trade mark, or name of contents, maker's name, etc. It then passes over two rolls, during which process the ink is allowed to dry. Afterwards a revolving disc, which dips into paste, applies

An Unlisted Caliper.

this latter to one edge of the paper. From these rolls it is folded over a steel plate to form a tube and thence it enters a series of rolls, the first of which presses the two edges together, the paste causing them to stick. The first cut, that of a very flat "V" with a saw-tooth line, forms part of the bottom of one bag, and the top of the following one. Another set of rolls crimps the top of the bag, so that it can be easily gathered in and tied when filled.



Special Paper Bag Machine.

The next operation takes place in the rolls, which do the side cutting. Here, the bottom of the bag is prepared for the "diamond fold." A set of rolls now applies paste to the bottom and from there it passes on to the final fold which brings the adhesive qualities of the paste into play. The bottom is afterwards flattened, that is, turned at right angles to its natural position when full. The bags now pass out of the rolls to a conveyor belt, which deposits them in a neat pile.

The prime mover is an electric motor, and a chain and two sprocket wheels connect the press to the machine proper. All of the rolls are driven by a train of spur gears on one side of the machine.

The apparatus is used for making charcoal bags, and although only designed to turn out fifty a minute, it is being operated at a slightly higher capacity. The machine with slight alterations in design can be made to produce any size bag, and is particularly well adapted for making bags for flour and feed mill products.

### INDUSTRIAL PROGRESS.

The fact that Armour & Co. have set aside a fund of a million dollars for the inauguration of a pension plan for employes is significant, not so much as regards the amount involved, but rather as exemplifying the tendencies of our great industrial factors in the direction of humanitarianism. There are 55,000 employes of Armour & Co. A million dollars, perhaps, will not go very far, but that is not the point. It is rather the fact that the policy of the directors of one of the world's great enterprises sees fit to reward conscientious service by eliminating the worry for future livelihood. Such movements in the great American industrial field will do more to eliminate impractical socialism than all the propaganda that could possibly be advanced by dreams of Utopian impossibilities!

### THE AMERICAN INSTITUTE OF METALS.

The result of the ballot on the question of changing the name of the American Brass Founders' Association to that of the American Institute of Metals, showed that out of 108 votes cast, 93 were in favor of the new title, and only 15 against. In view of the foregoing, the new name will be assumed just as soon as the necessary arrangements and announcements can be made.

The ballot, concerning the time and place of the annual convention, resulted in 92 votes being registered in favor of allowing the executive committee to determine the selection, and 16 votes against out of a total ballot of 108 votes cast.

The name of the Advance Machine Works, Limited, Walkerville, Ont., who are builders of Northern Cranes and Hoists in Canada, has been changed to Northern Crane Works, Limited. The company will continue the manufacture of cranes, hoists, etc., as heretofore.

They have recently completed a new plant at the corner of Argyle Road and Essex Terminal, in Walkerville, and report a large number of contracts in progress.

# C.N.R. Double Truck Type Gas-Electric Motor Car

By H. A. Wilson

*Canadian railroad enterprise is prominently exemplified in the accompanying article, and the success which has attended the efforts of those directly concerned will doubtless awaken widespread attention to and investigation of the possibilities of this motor in other spheres.*

THE rapidity with which the internal combustion engine has arrived at its present state of perfection has caused a great many to be more or less sceptical of its reliability. However, rapid as has been its perfection of details and design, its field of usefulness

Operating and Control Equipment.

has been increasing with equal rapidity. The latest application on Canadian soil takes the form of a gas-electric car for use on the shorter lines of steam railways. The car consists of a gasoline engine driving an electric generator which supplies current to the motors mounted in the trucks of the car.

### General.

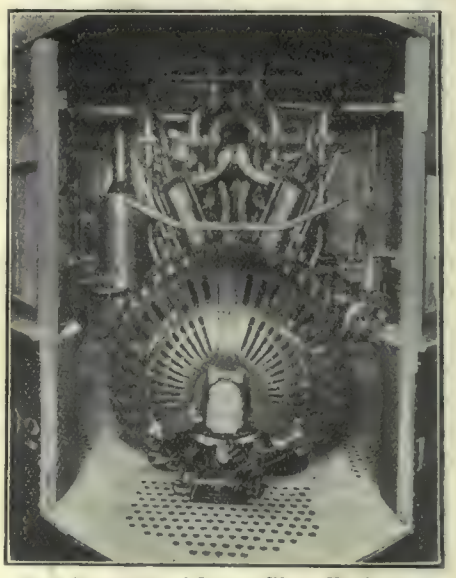
The engine is a 200 h.p. machine of the four-cycle type, having eight cylinders in two rows of four each. The cylinders are inclined from the vertical about 30 degs., and are "staggered" so that they can all be connected to a common crank shaft. They are also cast singly with separate heads. The heads are secured by long bolts through the cylinder directly to the crank case. The valves are operated by two cam shafts; one on each side of the engine looking after its set of four cylinders. Both intake and exhaust valves are situated in the heads of the cylinders, thus necessitating the use of rocker arms to actuate them.

### Fuel.

Gasolene is generally used as fuel but "Painters' Naphtha" has been extensively employed in the operation of these cars in the States. Two carburetors are used, one large and one small. The large one takes care of the engine when the car is running under ordinary conditions; the small one being used when the car is coasting or when for other reason the engine is not called upon to deliver much power.

### The Engine.

The cylinders are 8-inch. bore with a 10-inch stroke. The engine base or crank case, of cast iron, is fitted with large hand holes, the covers of which can be readily removed to inspect the main bearings and large ends of the connecting rods. The cylinders are of close-grained grey cast iron, developed especially for gas engine requirements. The main exhaust valve is located in the cylinder head, as before stated, but an auxiliary exhaust port in the side of the cylinder is uncovered by the piston as it reaches the end of its stroke. This exhaust port naturally assists in ridding the cylinder of all the burned gases. Each piston is of the trunk type, cast iron, and is fitted with snap rings of the same material. The wrist pins are of hardened steel, ground to size and clamped in the ends of the connecting rods. The bearings, of phosphor bronze, are in the piston. The connecting rods are of high carbon steel, drop forged and heat treated. The crank shaft is also made of high carbon steel and heat treated; with the coupling for connecting to the dynamo shaft forged integral. The bearings consist of bronze cages lined with babbitt, as also are the large ends of the connecting rods. A system of forced lubrication



End Elevation of Power Plant Equipment.

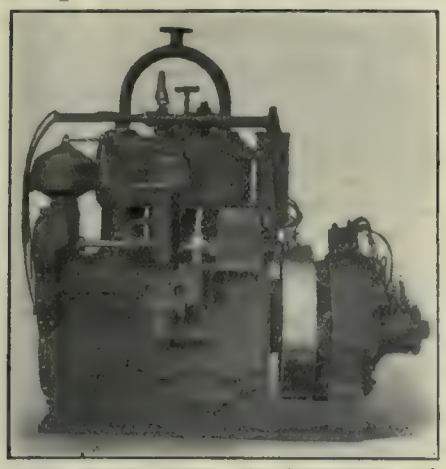
provides for the oiling of the cylinders and all the bearings, through ducts in the crank shaft.

### Carburetor.

The gasoline tank, the capacity of which is 100 gals., is situated under the body of the car. Consequently, the level of gasoline in the fuel chamber of the large carburetor can not be maintained by gravity and a cork float as is the common custom. The supply is delivered by a pump, and the surplus taken care of by overflow pipes leading back to the fuel tank. The carburetor is of the multiple venturi type. Warm air is

C.N.R. Gas-Electric Motor Car.

supplied to the carburetor in cold weather. It is also used to ventilate the crank case by a suitable connection. Great precaution is taken to prevent dirt, dust or other foreign matter from finding its way to the carburetor.



Gas Engine Driven Air Compressor and Lighting Generator.

Strainers are provided at both inlet and outlet of the main gasolene tank. When the engine is not in motion, gasolene can be pumped to the carburetor by hand.

### Ignition.

The ignition system consists of two low tension magnetos and magnetic make-and-break spark plugs. These latter are situated in the heads of the cylinders. Centrifugal switches are provided in the ignition circuits which prevent the engine from exceeding a safe speed.

The engine is water cooled, the radiator being situated in the roof of the car and circulation obtained by the thermo-syphon system. The radiator is of the five-tube type.

### Air Compressor.

Connected to the engine is an air compressor, which provides air for the brakes and also for starting the engine, it being too cumbersome a machine to crank by hand. It consists of a single air-cooled cylinder 4-inch bore by 4½ inch. stroke, driven from the crank shaft. When the engine is running at normal speed the compressor has a displacement of 22 cu. ft. of free air per minute. An automatic governor is attached and maintains a constant pressure in the air reservoir.

### Generator.

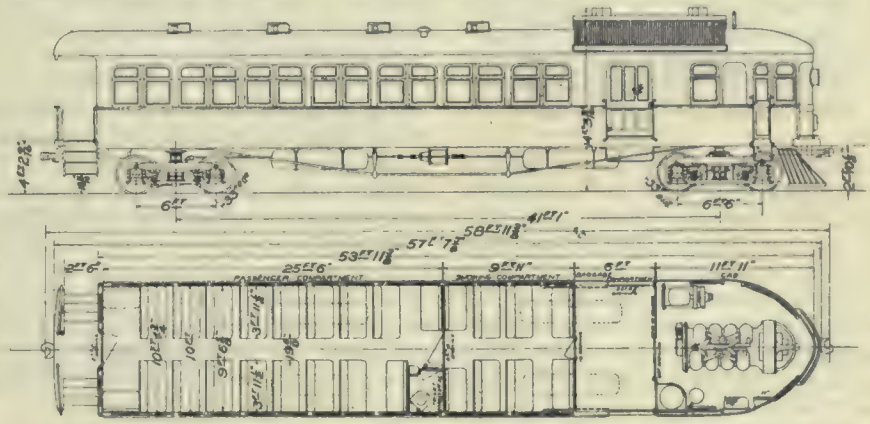
Direct-connected to the engine is an eight-pole, 600 volt commutating pole electric generator. The magnet frame is bolted directly to the end of the engine frame. The outboard bearing is ring-oiled and supported by a three-arm bracket. The design of the generator is standard with the slight alterations required to make it adaptable to the before-mentioned service conditions. This generator is designed to run at 550 r. p.m.; being the speed at which the engine delivers its rated power.

### Motors.

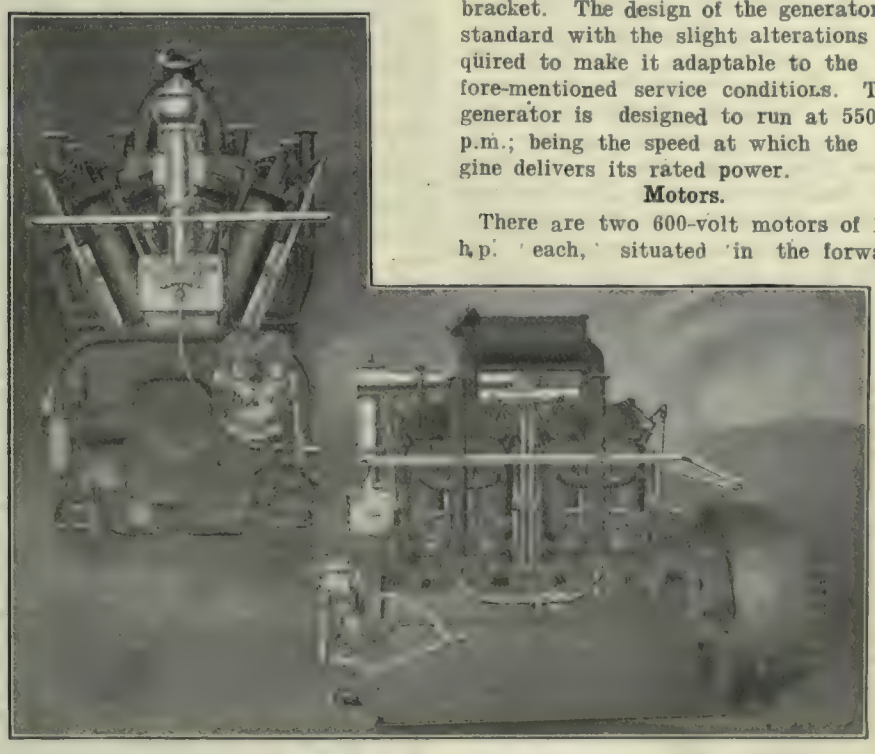
There are two 600-volt motors of 100 h.p. each, situated in the forward truck, one on each axle. Both front axles are, thus, driving axles and support from 65 to 70 per cent. of the total weight of the car; an important feature on grades or slipping rails. The motors are box frame, oil lubricating commutating pole railway type, equipped with standard gears and cases.

### Control.

The control is of a very simple type; starting being accomplished by compressed air. The throttle lever being opened one notch, delivers air to the engine and causes it not only to start but to attain nearly its normal speed. Then, as the throttle is opened wider, the gasolene is fed to the engine. The motor-control handle is placed just above the throttle lever, and is of a special type; the driving motors being placed progressively in series and in parallel, and the voltage governed by varying the strength of the generator field. A separate handle is provided for reversing the car. On the engine, a lever is provided for advancing or retarding the spark. Hand brakes are provided in addition to the combined straight and automatic air brakes. All fittings, such as hose, gauges, etc., are provided; the gauges being placed on the board immediately in front of the driver, so that he will at all times be aware of the exact pressure in his air tanks. An air whistle and a pneumatic gong form part of the equipment of the car. The ability to instantly reverse the motor furnishes a means independent of the air or hand brakes of stopping the car in cases of emergency. The electrical control furnishes an infinite number of gear ratios without change gears, which gives the car a smooth and rapid acceleration.



Sectional Plan and Elevation, C.N.R. Gas-Electric Motor Car.



End and Side Elevations of P ower Plant Equipment.

### Lighting Unit and Auxiliary Air Compressor.

The car has a small auxiliary engine which operates an auxiliary air compressor and supplies power to a dynamo for lighting purposes. This engine is a four-cycle, two-cylinder vertical gasolene unit. The air compressor cylinder is placed between the two-engine cylind-

ers, as shown in the accompanying cut, and is cast in a single piece, provided with a common water jacket. The diameter of the engine cylinders is 4¼ inches and the compressor cylinder, 5½ inches; the common stroke being 6 inches. The cylinders are of the T head type, that is, the combustion chambers overhang the cylinders on both sides; the exhaust valves are placed on the opposite side to that of the intake valves and usually only require one link, namely, the push rod to connect the cam to the valve stem which is forged integral with the valve. Thus, two cam shafts are required, one to operate the intake valves and one to operate the exhaust valves. This compressor cylinder has a displacement of 45 cu. ft. of free air per minute, which is also stored in the tanks under the body of the car. The air is used to charge the tanks and start the main engine when the car has been idle for some time and there is not sufficient air remaining in the tanks to do this. The small engine is easily cranked by hand.

Directly connected to this engine is a 125-volt generator of 1½ kilowatts capacity. This generator supplies the current required by the interior incandescent lights and the 50 c.p. headlight. A centrifugal governor is provided which keeps the speed at 600 r.p.m. The connecting rods are of high carbon steel, drop forged and heat treated. The lubrication is effected by means of a constant level splash system. The ignition system consists of a low tension magneto with magnetic make-and-break spark plugs which are interchangeable with those on the main engine. Batteries are supplied to facilitate hard starting. The generator armature is bolted to the flywheel on the end of the crankshaft. The valves in the compressor cylinder are automatic in their operation and are both in the head of the cylinder.

### The Car.

The distribution of weight is approximately as follows:—

| | Pounds. |
|---|---|
| Body ..... ... ... ..... ..... ... ..... | 33,000 |
| Trucks ... ..... ..... ..... ..... | 20,000 |
| Motors and control ..... ..... | 8,500 |
| Gas engines and accessories ..... | 24,000 |
| Passengers (60) ..... ... ... ..... ... | 8,400 |
| | 93,900 |

The total weight thus approximates 47 tons.

The car can negotiate all grades up to 1½ per cent. with comparative ease, and can be driven up to about sixty miles per hour, but will travel forty-five with no difficulty whatever. When the service demands, it will pull a trailer.

One great factor which is manifest when negotiating grades and running in deep snow is that the tractive effort of the car remains constant regardless of its speed, provided the engine speed is maintained. All the engine parts are readily accessible in case of renewals or adjustments. Then, too, the engine is mounted on the floor frame of the car and all sudden jars are absorbed in the springs and are not transmitted to the engine. Dust and dirt do not readily find their way to the reciprocating parts, thus eliminating a great deal of wear.

The maintenance of the car is very low indeed. About two miles on a gallon of gasolene is the figure arrived at, after exhaustive tests over a considerable period of time. The crew consists of but two men, a motorman or engineer, and a conductor. The total operating cost in Canada will probably average about 20 cents per mile, but will vary a great deal according to local conditions, such as grades, distance between stops, traffic, etc.

The car is heated by hot water; the water being heated in a hot water heater in which anthracite coal is burned. This heater can be connected to the water cooling system of the engine when the car remains idle over night in cold weather, thus preventing the water from freezing in the radiator. As there is no smoke or cinders in connection with the power plant, the windows can be opened in warm weather. The engine is well muffled and the car runs with little noise and vibration.

This type of car is in no way an experiment, because similar types have been operated on American roads for a considerable time back. The car, however, has excited a great deal of interest and many people are closely watching its performances. On Saturday, April 13th, after trial trips had been run, it journeyed to Trenton on the new Toronto-Trenton line and ran between Trenton and Picton on the Central Ontario road which is now owned and operated by the Canadian Northern Railway, the owners of the car. On this route it was necessary to haul a trailer to care for the traffic. An ordinary railway coach was coupled on and the car carried the additional load to the satisfaction of all. The Canadian Northern intends to use the car near Quebec during the summer on tourist traffic.

## CAN. FAIRBANKS-MORSE CO., LTD., MONTREAL.

Lewis C. Randolph has been appointed advertising manager of the Can. Fairbanks-Morse Co., with office at Montreal. Mr. Randolph is a graduate of Hampden Sidney College and Virginia Polytechnic Institute, and in addition to an engineering experience of several years, he has been on the staff of the Railway Age Gazette and advertising manager of the Corrugated Bar Co., Buffalo.

## CONSUMPTION OF COAL IN CANADA.

In 1911, the total consumption of coal in Canada amounted to about 24,408,000 tons, made up as follows:—9,800,000 tons produced in Canada and 14,600,000 tons imported. According to the figures Canada produces only 40.2 per cent. of the coal which it consumes. It must be noted, however, that if all the coal mined in Canada had been used in the country, it would have constituted over 46.2 per cent. of the consumption.

The consumption of coal in Canada has increased from 3,450,111 tons in 1886, to 24,400,000 tons in 1911. During the same period the coal consumption per capita has increased from 0.758 tons to 3,389 tons.

## NOVEL TYPE LOCOMOTIVE.

A novel type of locomotive is being developed under the patents of James Dunlop, of Glasgow. It is driven by compressed air, which is supplied by an oil engine-driven compressor. The compressed air is used on the closed circuit, sometimes called the dense-air system, in which a certain quantity of air passes continuously from the compressor to the engine or driving air motor, and then back to the compressor again. Leakage is automatically made up by a small auxiliary compressor. It is claimed that the closed-circuit system is more efficient than the open-circuit system, in which fresh air is continually being taken in by the compressor and the exhaust from the motor ejected to atmosphere.

In the closed-circuit system the average air pressure throughout the system is maintained at some definite figure, say 150 lbs., per square inch, the intake pressure at the motor being higher and the outlet lower. The range of pressure is governed by the control of the compressor and the cut-off of the motor. The compressor may be controlled by varying its speed, but more usually by altering the number of cylinders in action, this being done by lifting the air delivery valves off their seats in those cylinders to be put out of action. The air in the delivery main is then merely drawn in and pushed out through the open valve.

It is claimed that the fuel cost will be $2.11 per 1,000 effective horse-power hours with oil at $9.75 a ton, as against $3.75 for a steam locomotive with coal at $2.43. These costs are based on 0.5 lbs. of oil per B.h.p. at the engine, a recovery of 16 per cent. of the heat in the exhaust gases, and a mechanical efficiency for the locomotive of 90 per cent.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## SWEEP MOULDING AN OIL TANK IN GREENSAND.

By J. H. Eastham.

THE oil tank shown in plan and section views at Fig. 1 was urgently required to complete an order for elevator castings. The pattern

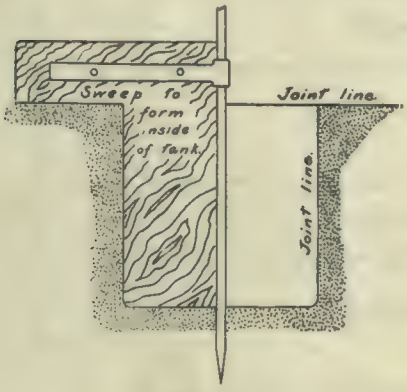



Fig. 2.

store having been thoroughly but unsuccessfully searched for the complete pattern formerly used it was concluded that the latter had been lost or accidently broken up and privately commandeered.

To secure speedy delivery, therefore, the sweep shown by Figs. 2 and 4 was made; the seating brackets, bosses and inside flanges being loose and bedded to

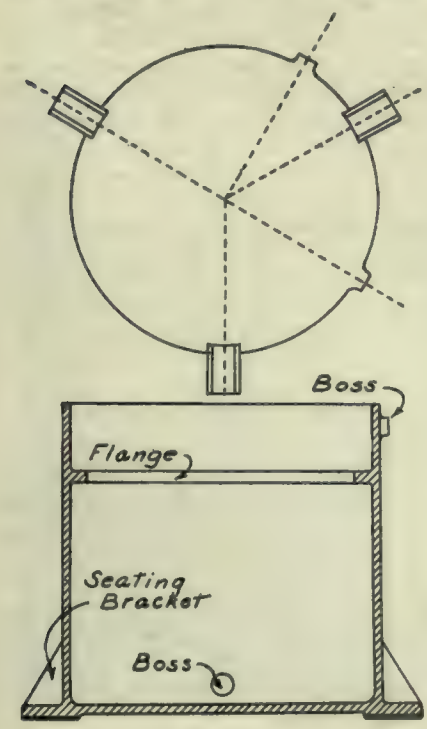



Fig. 1.

correct place by measurement. The sweep, with thickness piece removed, was bolted to the spindle arm, as shown at Fig. 2, then a bed, the exact size of the inside of the casting required, was strickled out and lined up with parting sand. A layer of facing sand one inch deep was next spread over the bottom, and the lifting grating shown by Fig. 3 stamped down on this; the inside being rammed-up to the depth shown. The six sections of flange forming the full circle were afterwards bedded, well ironed over and under and the ramming of the core continued to the top of the lifting eyes.

The cope was now lowered to place and rammed up in the usual way; a hook bolt being passed under the bend of each lifting loop attached to the grating and packed tightly by fish plates and suitable washers. The cope with core attached was then removed and

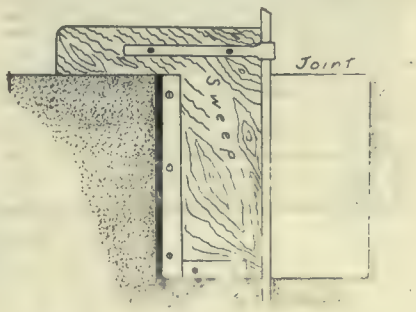



Fig. 4.

turned over to permit of necessary finishing; the inside of the drag mould being scraped away to allow placing in position the sweep with thickness piece attached, as shown by Fig. 4. The mould having been strickled to full outside width of casting, the sweep was again removed and the three seating brackets bedded to place, ironed in corners, vented and drawn inward.

Following this operation, the outlet boss was bedded in the side of the mould, its centre being two inches from the bottom and equidistant from two seating brackets. The inlet or feed boss was next located at right angles to the outlet, its centre being two inches from the top of the rim. Both cope and drag having been coated with plumbago blacking, the former was next washed with molasses water, skin dried, tried on, and inspected with a view to finding possible crushes; clay "finders" being placed at intervals on the bottom face to show thickness of metal allowed. These removed and minor defects corrected the cope was lowered again to position, weighted and the piece poured.

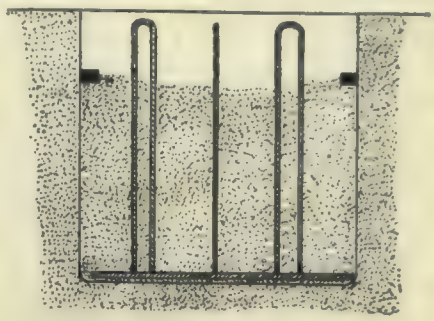


Fig. 5.

## STEEL CASTINGS.

A LECTURE on "Steel Castings" was delivered before the London branch of the British Foundrymen's Association by Mr. H. Brearly, of the Brown-Firth Research Laboratory, Sheffiled. It was pointed out that the coarse crystalline appearance, which the fracture of steel casting was supposed to have, was not now a sufficient distinction between castings and forgings. Examples of the coarse crystalline fracture of a steel casting was suppposed to slowly cooled were exhibited, and also illustrated by lantern slides, side by side with portions of the same casting after heat-treatment. The exposed fractures

Fig. 3.

of the latter were in all respects indistinguishable from well-wrought forgings. The lecture was mainly devoted to the processes involved and the structural changes taking place between these two extremes.

The lecturer emphasized the workshop value of careful observation of fractured and prepared surfaces with a hand lens or any other available magnifying outfit, and then showed by a series of low-power photographs the wonderfully perfect structure of the interior of separate crystalline grains of mild steel. By the same means, the defects arising in and about the crystalline grains were demonstrated, and a clear impression conveyed of the objects to be attained by annealing.

The portion of the lecture which dealt with the fragility of unannealed steel castings was well illustrated and conveyed a clear reason for their erratic behavior. The lecturer thought it highly undesirable that unannealed castings should be brought into any kind of service where trustworthiness was called for; and showed, quite apart from the question of cooling stresses, how they might be expected to fail and how the important question as to whether or not a casting had been successfully annealed could be determined by simple means. The main object to be accomplished by annealing was said to be the elimination of the coarse crystalline structure, due to cooling from the liquid state, and the substitution of a much finer structure by methods which varied with the composition of the steel. Some very clear slides illustrated the hindrances, which occurred in uncontrollable ways, and prevented the attainment of this object, and led also to that kind of rupture between the crystals known to the foundryman as pulling.

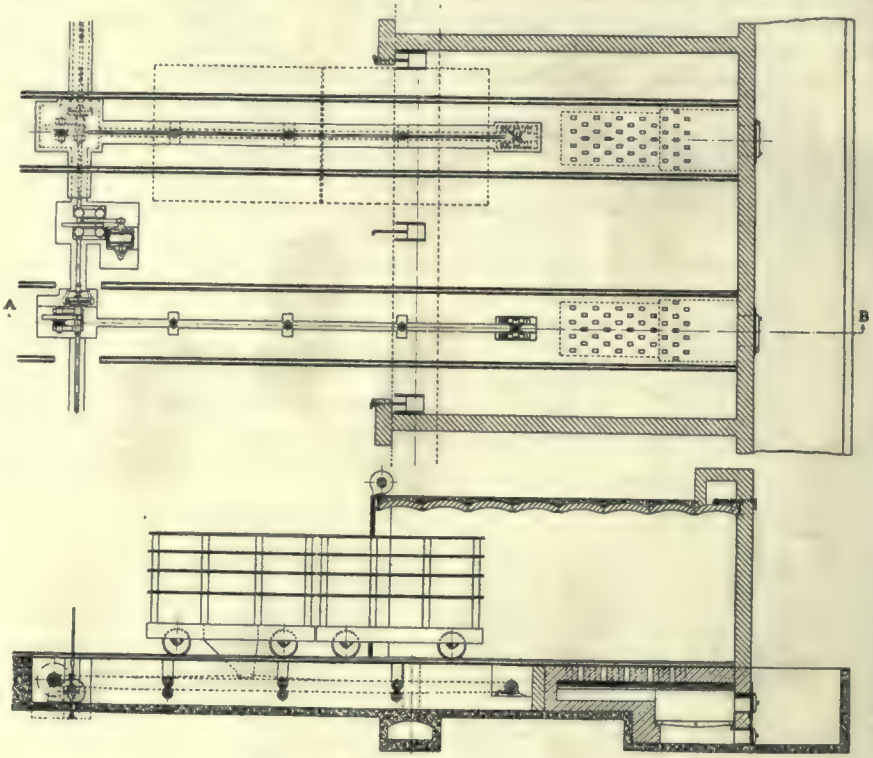
The pulling of metal as it passed from the fluid to the solid state was only briefly referred to, and illustrated by a few instances occurring in simple shapes usually cast in chill moulds; but more attention was paid to the manner in which castings of varying cross-section might bring themselves to an untimely end during cooling from a red heat to atmospheric temperatures. Alloy steels appeared to be very tricky in this respect, which accounted to some extent for the unwillingness of many manufacturers to utilize them for sand castings. It would appear, however, that the difficulties were of such a kind as could be overcome by intelligent care and close observation.—T. E. S.

## ELECTRIC PULLER MACHINES FOR CORE OVENS.

THE accompanying illustrations show plan and sectional elevation of a large core oven equipped with an electrically operated machine recently put on the market by the Whiting Foundry Equipment Co., Harvey, Ill., for hauling cars in and out of core ovens. It does away entirely with the necessity for snatch block and tackle operated by overhead crane or laboring gang, and eliminates the disagreeable and irksome task of hooking on to cars in a hot oven or pinching them out.

The apparatus consists of chain pocket wheels and gearing mounted on heavy cast iron bearing brackets securely bolted to suitable foundations in the vertical plane of the tracks for core oven cars. An endless forged chain passes over pocket wheels, being carried by idlers located in a slot below the level of track and attached to an arm extending from the car into the slot. One of these mechanisms is furnished for each track in the battery of ovens. Power is applied by reversible electric motor, using either alternating or direct current through gearing to driving shaft. Each pulling mechanism is controlled by independent friction clutch.

All operating mechanisms are located below floor level in concrete pits, which are covered by floor plates to protect apparatus and prevent accidents. The arrangement may be applied to gas or oil-fired ovens, as well as to the coke oven shown. Also, by modifying the construction somewhat, installation may be made in existing ovens. The location of machines in front of ovens is preferred, but if necessary they may be set in the rear.




SECTION A-B

Electric Puller Machine for Core Ovens.

## STEEL WORKS MUST SMOKE.

In an address before the Sheffield Electro-Metallurgical Society Prof. J. O. Arnold took occasion to censure the smoke-abatement movement and to point out that without smoke, steel is impossible. So far as health is concerned, he said, the most mischief is caused by the household smoke, yet it is usually ignored by the smoke inspectors. Strange as it may seem, some medical men have recently taken to recommending the smoky parts of Sheffield for sufferers from asthma. Prof. Arnold asserts that in steel metallurgy, smoke is absolutely necessary. Any operation that removes the carbon will produce poor steel. If a smokeless flame is used, all the carbon is burnt out and the surface of the steel is made rotten. Most municipal authorities realize that smoke is essential to the manufacture of good steel and exempt metallurgical furnaces, but the question of mixed stacks is continually coming up to the annoyance of manufacturers.

## MUST BUY IN CANADA.

The Canadian government will hereafter require all materials used for railways subsidized by parliament to be purchased in Canada. An understanding to that effect at present exists, but complaints have been made that it is frequently disregarded, especially in the west. A specific clause providing for the purchase of all material in Canada will in future be inserted in all subsidiary contracts.

# The Plant of Harland & Wolff, Queen's Island, Belfast

By Lagan

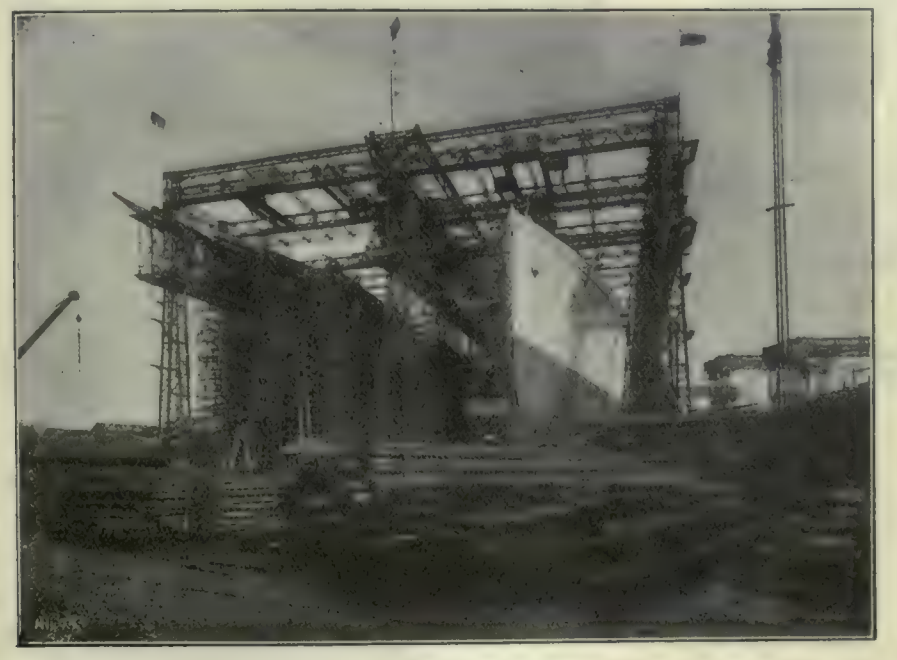
*This firm's world-wide reputation and achievements in shipbuilding and marine engineering are known and discussed by men in every section and department of the profession; therefore, the accompanying brief description of the plant and equipment, wherewith the superlative degree of performance has been attained, should contribute to the instruction and education of all classes of our readers.*

COMPARATIVELY speaking, the firm of Harland & Wolff is not an old one; but the fact that it has, within a period of little over half a century, risen from being an insignificant establishment covering but a few acres and employing a couple of hundred men, to the position of the finest shipbuilding and engineering works in the world, marks its progress as nothing less than phenomenal. The ground now occupied is upwards of 120 acres, while between 14,000 and 15,000 hands are employed.

Harland & Wolff first began to make history in shipbuilding by the construction of the early Bibby liners, which were a complete departure in the matter of proportions from previous practice; some of these vessels being 10-11 beams to length. A few years later began their connection with the White Star Company, the building of the first Oceanic, pioneer steamer of that line, marking another innovation; the vessel being the first in the Atlantic trade to have passenger accommodation amidships. Since then, they have rarely for any great length of time been without a White Star boat on the stocks. Amongst many notable vessels built by them for this company may be mentioned the Teutonic and Majestic—the great fliers of their day. Following them, came the leviathans, Oceanic (the second), Celtic, Cedric, Baltic and Adriatic; which, in turn, have been easily surpassed by the

Floating Crane.

46,000-tonners, Olympic and Titanic. These, again, are to be eclipsed in point of size by a steamer presently building at Queen's Island, for Ismay, Imrie & Co.



Olympic and Titanic on the Stocks.

### Large Tonnage Vessels a Feature.

Lord Pirrie has always been a strong advocate of the big ship, and the large number of leviathans put in the water from the Queen's Island stocks affords striking evidence of shipowners' concurrence in his views on naval architecture. Within the past twenty years or so, close on 60 of the vessels launched there, have been over 10,000 gross tonnage each. Of these a considerable number exceed 15,000 and 8 have a gross tonnage of over 20,000 each; two—the Olympic and Titanic—being vessels of 46,000 tons gross. The firm holds the record output for 1911, a distinction attained also in previous years. A shipbuilding company occupying such a position must, therefore, necessarily have extensive premises equipped with the most up-to-date machinery for expeditious and economical production, and in this respect, the Queen's Island shipyards and engineering works are unsurpassed.

### Yard Equipment.

At the south end of the yard two of the slips are served by a double-armed cantilever crane travelling on a high gantry which extends between, and the whole length of these ways; while at the north end there are the huge gantries under which the Olympic and her sister-ship Titanic were constructed. On these are numerous electric traveling cranes for light and heavy lifts, capable of lifting and depositing material over the entire area of the two slips. The aggregate brake h.p. of the motors used for driving the cranes, riveting plant, etc., carried on these gantries is over 1,400. Then, there is the monster floating crane which is used for lifting engines and boilers on board. This crane was tested to a load of 200 tons.

Turning now to the shops, in the platers' sheds we find here the same evidence of up-to-dateness; the tools—plate bending rolls, punching and shearing machines, etc.—being of the very latest types, and all driven by electricity generated in a central station which for size and contents is hard to surpass anywhere. In the various other departments we find the same principles of perfect equipment and organization carried out. The buildings are all extensive, lofty, well lighted, and replete throughout with the latest products of

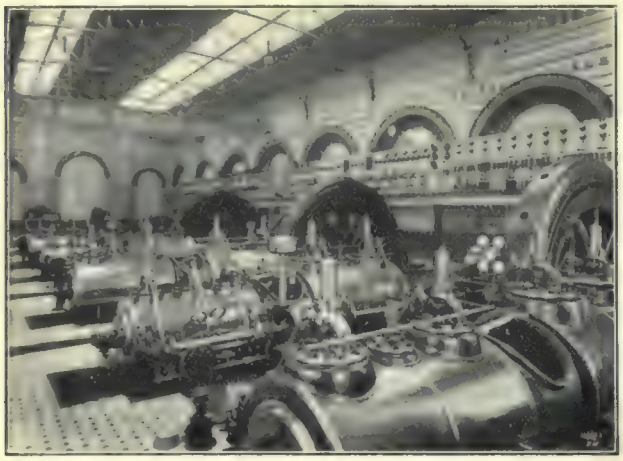
the brains of those whose attention is given to the labor-saving problem.

**Erecting and Heavy Machine Shop.**

The total length of the recently built erecting and heavy machine shop is 750 feet, the total breadth is 89 feet and the total height is 77 feet 6 inches. The design, generally, provides for a construction in which rigidity and stiffness, as well as strength, have been given careful consideration. The roof is entirely covered with glass except for the ventilator hood; the glazing being of rough cast plate 1-4 inch thick, laid in putty, and so arranged as to give the maximum amount of light possible. Large windows are fitted along one side and smaller ones at the top near the roof. One end, opening on Queen's Road is built of brick.

A gangway has been fitted inside the shop to give access to the crane girders, and another one outside gives access to the roof; both being protected by handrailing. Three overhead electric travelling cranes are provided, two of them capable of lifting together 200 tons and the third 25 tons. The floor is laid with Jarrah wood blocks, supplied and laid down by the Acme Flooring & Wood Paving Co. on a foundation of 9 inches of concrete.

A line of rails connects with the Harbor Tramway in Queen's Road, to a heavy turntable near the centre of the shop, which in turn connects with the iron foundry. Irish Standard gauge rails at the upper end of the shop communicate with the brass foundry. Narrow gauge tramways communicate with all shops.



Electric Power Station.

A bay of the machine shop.

**Machine Tool Features.**

The following is a short description of the larger and most important machine tools which have been installed:—

One universal double horizontal boring, drilling, tapping, studding and milling machine by Thos. Shanks & Co.

The slide bed of this machine is strongly constructed and is 26 ft. long by 5 ft. broad. Mounted on the slide bed are two strong box section vertical columns which slide along the bed both by hand and power, the power movement being through an independent motion shaft, driven by an auxiliary motor of 12 B. H. P. The columns, which have a horizontal traverse, give a maximum range of 20 ft. between centres of spindles. The spindle, which is carried on a slide mounted on the vertical columns, has a vertical range of 13 ft. The main drive is from two separate and independent variable speed, shunt-wound, 18 h.p. motors—one mounted on each column and sliding along the bed with it, connected with the necessary gear so that no long driving shafts are in the bed, while the drive over each spindle is entirely free and independent of the other, both for speed and direction. The spindles are 4 3-4 inches diameter, with a traverse of 36 inches. The work table which is bolted to the sliding bed is 20 ft. by 10 ft.

One heavy, quadruple geared, double bed, turbine lathe by Shanks & Co., for turning turbine rotors.

This has a double sliding bed of great width and depth and of special section to resist strains. The fast headstock of massive design has a forged steel spindle with large diameter in the front journal, also thrust rings for end pressure. The arrangement of gearing is Shank's latest improved plan with quadruple and double purchase driven by a direct connected, shunt wound, variable speed 60 b.h.p. motor. This new drive is of the simplest character, ensures silent run-

A portion of the boiler shop.

New addition to machine and erecting shops.

ning and reduces torsion through the shafts, at a minimum expenditure of power. The saddles are 4 in number, specially constructed for heavy strains, and have independent power traverse either way through the racks. This lathe is 100 inches centres, will admit 50 feet between same and will swing over the saddle 14 ft. 11 inches, and over the shears 16 ft. 9 inches. The gross weight is about 174 tons.

One vertical and horizontal planing machine for machining turbine casings, engine bedplates and large general work of all kinds:—

The foundation bed is of very strong design. The work table, a small part of which is cast in the foundation bed, has its main portion securely checked into the foundation bed, and firmly secured there with bolts. The vertical bed is in two castings of specially strong and rigid design. The travelling standard is of large box section strongly ribbed and capable of withstanding heavy cuts without spring. The machine is driven by a 30 h.p. motor direct-connected to the machine by the necessary gear. A platform is fitted to the traveling standard and also to the saddle thereon, so that the attendant may constantly follow the surface being machined.

One patent steam turbine casing boring machine:—

This consists of three parts:—(a) the machine proper; (b) two heavy double stays; and (c) baseplate for supporting the work. The machine includes a wide slide bed with two driving shafts, and in the middle a guide screw; while on the outside it is provided with a planed tee groove for facilitating the setting of the column when grooving. A strong box section column slides upon this bed, with quick power reversing speed, and two independent systems of variable feed. The headstock saddle is balanced and has power vertical adjustment to obtain the exact height from work plate required. The drive is from a 40 b.h.p., shunt-wound, variable speed motor, 300 to 900 r.p.m. The motor is placed at the end of the bed and connected to the driving shafts in the slide bed by the necessary cut wheels; giving 40 speeds through worm wheel slow drive, and 40 speeds through the bevel gear quick drive. These are so arranged that the one drive must be clear and disengaged before the other can be engaged. Two heavy double stays are fitted for carrying the boring bar. The baseplate for supporting the work and the boring stays consists of four castings planed on the joints, securely checked and bolted together. The principal dimensions of this machine are:—width of slide bed, 8 ft. 6 inches; traverse of column, 9 ft. 6 inches; largest diameter to bore, 17 ft.; maximum height work plate to centre of spindle, 9 ft. 6 inches; diameter of worm wheel, 8 ft; and size of baseplate, 45 ft. 10 inches by 16 ft. This machine is also by Messrs. Shanks.

One vertical cylinder boring machine with 16 inches diameter boring bar, capable of boring cylinders 112 inches diameter by 75 inches stroke.

One vertical cylinder boring machine with 15 and 11 inch boring bars, capable of boring cylinders 80 inches diameter by 60 inches stroke.

Two surface tables, each 20 ft. x 15 ft. x 18 inches deep, are placed 3 ft. apart, so that they can be used either singly, or if required for larger castings or shafts, the two tables can be used together.

A large bed has been made for erecting engines. It is 136 ft long x 50 ft. wide over all, and has nine rows of concrete blocks, 2 ft. square; the whole length of the bed being supported by 176 pitch pine piles 13 inches square by 30 ft. long. On this bed five or six sets of marine engines can be erected simultaneously, according to their sizes.

White Star Line Steamship "Titanic," Which Foundered in Mid-Atlantic on the Early Morning of April 15, 1912.

### Allied Accessory Equipment.

Harland & Wolff have from time to time added various allied branches of the shipbuilding and engineering industries to their works. They have had from the first their own iron and brass foundries; while some years ago they built a fine coppersmiths' shop, and about the same time took up electrical engineering for the fitting-out of their vessels with electric light installations. Now they are about to commence the making of refrigerating plants, which, hitherto, have been supplied them by firms who make a specialty of this class of work. They have for many years made the great bulk of auxiliary machinery required on shipboard, and non-conducting material for boiler covering is manufactured and applied by their own staff.

### Management Features.

Throughout the entire establishment—shipyard and engine works—it may be said that a weeding-out is in constant process; Lord Pirrie's dictum in this respect being to the effect that as soon as an improved type of any class of machine is brought out, the old tool must go. The finest works in the world, however, in any business, will not make for economical and efficient production if proper management is lacking. Harland & Wolff's operations are conducted by an efficient staff working under capable management, and above all, there is Lord Pirrie's guiding hand.

# Steam Heating and Isolated Power Plant Cost

American Engine Co. Report.

*There is here discussed a variety of conditions likely to be met in the realm of Isolated Plant Power with Steam Heating as its basis. Climatic conditions in Canada call for a more or less protracted season during which steam heating is necessary and in the development of our manufactures, a large degree of isolation often becomes necessary, therefore, the typical examples and figures given, relative to costs involved, will be found interesting and valuable.*

WHERE steam heating is required, electric power may be generated as a by-product of the heating plant, at a cost of less than 2 cents per kilowatt-hour in the majority of cases. The reasons for this low cost of generation may be summarized as follows:

(1)—The fixed costs, which go to make up a large share of the cost of power, are chargeable only against the additional investment for the plant by which electric power is generated, over and above the investment for the low pressure steam heating plant.

(2) — The coal cost chargeable against electric power is reduced, during those periods when the exhaust steam is used for heating, to a small percentage of the coal consumed, representing that part of the heat in the steam which is lost between the high pressure boiler and the heating system.

(3)—The labor charge comprises only the additional labor required, as compared to a low pressure heating plant. Furthermore, by reason of the additional labor, which is of a higher grade, greater economy is obtained in fuel consumption, amounting to a saving in coal of 5 to 15 per cent., which in a plant of fair size will pay the wages of an engineer.

(4)—While the charges for oil, waste, repairs and miscellaneous items are incurred entirely through the installation of the engine and generator, they amount to a small proportion of the total expense.

Every isolated plant with exhaust steam heating must be considered as a separate problem, because of the wide variation in load, cost of coal, water, labor, etc. The following case, which may be presented as a typical one, will serve to outline the calculation whereby the cost of power may be determined, and, secondly, to indicate the influence on the cost per kilowatt-hour of the three most important factors—the fixed charges, the price of coal and the amount of exhaust steam used for heating.

### Fixed Charges.

An industrial plant operating 3,000 hours per year, with an average load of 200 K.W., will be assumed. Two 100-K.W. and one 50-K.W. engine-driven dynamos, installed with suitable piping and appurtenances, will cost about $11,000.

Two 200-H.P. boilers would be required; however, the total cost of these boilers would not be chargeable against power, since boilers would also be required for the low pressure heating plant. The cost per horse-power of low pressure boilers, grates, stack, etc., is about the same as a similar high-pressure equipment. Because heat is lost and consumed between the high pressure boiler and the heating system, a somewhat greater boiler capacity must be installed when power is to be generated, and as the exhaust from an engine contains from 80 to 90 per cent. of the heat given to it by the boiler, an increase of the latter's capacity of 25 per cent. over the low pressure equipment will take care of this item and also any additional cost of a high pressure boiler as compared to a low pressure equipment.

At $18.75 per horsepower, including boiler, grates, stack setting, piping and labor of installation, the additional boiler cost is $1,500. This additional boiler cost will vary; in fact, in plants already equipped with low pressure boilers, it will pay to replace the equipment with high pressure boilers and utilize exhaust steam for heating.

The two largest items of additional first cost, totalling $12,500, have been considered. It might, of course, be profitable to install other apparatus in a plant of this character, as for instance a feed-water heater, but as that piece of apparatus should pay for itself out of the coal saved, it will not be considered under the items of additional first cost.

Of the total additional cost of $12,500, a certain fixed percentage must be charged annually against the cost of power. The fixed charge may be set down as follows: Interest, 5 per cent.; depreciation at 5 per cent.; insurance, real estate, upkeep, obsolescence, 5 per cent.; total, 15 per cent., or $1,875, which is the fixed charge per year against the additional investment for apparatus to generate power as a by-product of the heating system. The cost for additional labor may be taken as one man at $800 per year, while repairs, oil, waste, packing, etc., may be set down as $250, making a total of $1,050.

### Coal.

The coal chargeable against power comprises the coal equivalent of the heat lost between the high pressure boiler and the heating system when the heating season is in use. When no heating

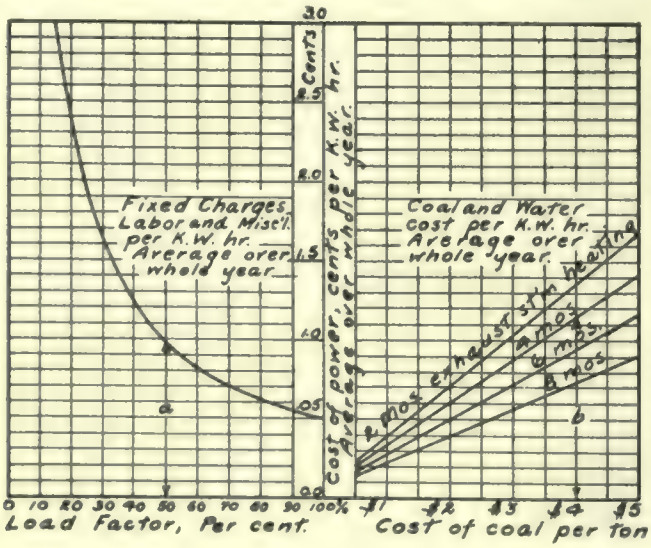

Cents
Fixed Charges, Labor and Misc'l. per K.W. hr. Average over whole year
Coal and Water cost per K.W. hr. Average over whole year
Cost of power, cents per K.W. hr. Average over whole year
Load Factor, Per cent.
Cost of coal per ton

Fig. 2—Average yearly costs of coal, water and fixed charges per K.W. hour.

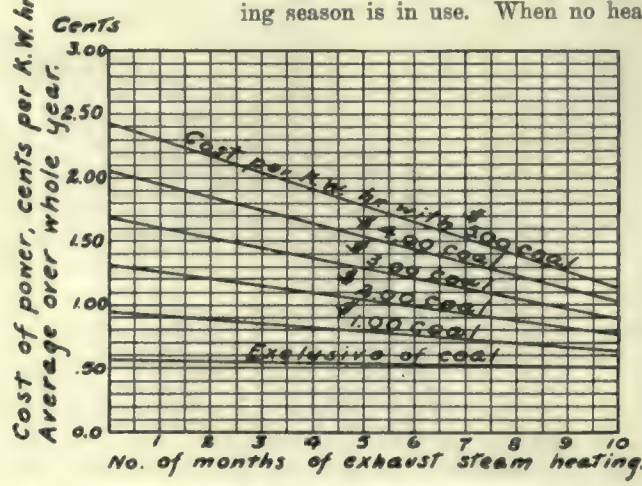

Cents
Cost of power, cents per K.W. hr. Average over whole year.
Cost per K.W. hr. with $4.00 coal
$3.00 Coal
$2.00 Coal
$1.00 Coal
Exclusive of coal
No. of months of exhaust steam heating.

Fig. 1—Cost of power per K.W. hour for various prices of coal and periods of heating with exhaust steam.

is being done, all of the coal burned under the boiler is chargeable against power. The cost for coal will, therefore, depend upon (a) the steam consumption of the engines per K.W.-hour; (b) the efficiency of the boiler; (c) the cost of coal; (d) the percentage of the total amount of steam generated which is used by the heating system.

(a)—The steam consumption of an American-Ball angle compound engine is 26 lb. per horsepower-hour (non-condensing), or 40 lbs. per kilowatt-hour. In order to be on the safe side and to take care of the effect of reduced and fluctuating loads on steam consumption, assume 60 lbs. of steam per kilowatt-hour.

(b)—Assume a boiler efficiency of 60 per cent., or about 8 lbs. of steam per pound of coal.

(c and d)—The cost of coal and the proportion of the total steam generated which is used in the heating system, are both variable.

In the Table given herewith, the cost of coal ranges from $1 to $5. The amount of steam used in the heating system is taken care of by considering it as the number of months of the year when all the exhaust steam is used for heating.

Strictly speaking, at the beginning and end of the heating season, there are periods when only a moderate amount of heating is required and only a portion of the steam exhausted by the engines is utilized. This decrease in heating load may be taken care of by assuming a shorter heating season. For example, suppose that for four months during the winter, all the exhaust steam was used in the heating season and that for one and a half months before and after this season the amount of steam used in the heating system varied from zero to full capacity. It would then be quite accurate to assume that the heating season of 7 months would be equivalent so far as amount of steam used for heating, to a season of 5½ months in which the heating load was always equivalent to the full exhaust of the engine.

### Water.

An average price for water is 10 cents per 1,000 gallons. During the heating season it is reckoned that only 80 per cent. of the water is returned to the boiler. During other periods all the water is lost. It should be noted that it is assumed that in a low pressure heating system all the water is returned to the boiler, that is, there is no loss, and in setting down the additional cost for water when power is produced as a by-product, it is assumed that condensation in high pressure steam piping, condensation in the engine, etc., results in a 20 per cent. loss during the heating season and when the steam is exhausted to atmosphere, a 100 per cent. loss. With the fixed costs, labor cost, already given, and calculating the coal and water charges for given conditions, the table and charts shown were obtained. The following example will serve to explain in detail the method of obtaining these figures.

Example.—Assume the heating season equivalent to six months of full load steam heating, during which all the exhaust is used. During this period the coal chargeable against power is the equivalent of the steam and heat lost between the high pressure boiler and the heating system. Assume, also, that 20 per cent. of the heat of the steam is lost in this manner. The other factors entering into the coal cost have already been given—load 200 K.W.; steam consumption 60 lbs. of steam per K.W.-hour; coal consumption of 1 lb. of coal per 8 lb. of steam, and hours per year, 3,000. With coal at $4.00 per ton, the cost of coal during the 6 months heating period is $900.

The part of the year when there is no exhaust steam heating, and those parts of the year when only part of the exhaust steam is used for heating, are equivalent to six months of straight non-condensing operation. The cost of coal is therefore $4,500. To this coal cost must be added the cost for water at 10 cents per 1,000 gallons. During the heating season, the heating sytem returns 80 per cent. of the boiler feed and the cost for water is $43.20.

**COST OF POWER IN CENTS PER K.W.-HR. IN A TYPICAL ISOLATED PLANT; AVERAGE LOAD, 200 K.W.**

| Months of Exhaust Steam Heating | —Price of Coal, Dollars Per Ton— | | | | | |
|---|---|---|---|---|---|---|
| | $0 | $1 | $2 | $3 | $4 | $5 |
| 2 | .550 | .880 | 1.200 | 1.525 | 1.850 | 2.175 |
| 4 | .540 | .820 | 1.090 | 1.365 | 1.640 | 1.915 |
| 6 | .531 | .755 | .983 | 1.205 | 1.431 | 1.656 |
| 8 | .521 | .700 | .871 | 1.046 | 1.221 | 1.396 |

For the other six months the cost for water is $216.

We may now set down the total charges for generating power at the rate of 200 K.W. for 3,000 hours a year, as follows:

| | |
|---|---|
| Fixed charges ..... | $1,875 00 |
| Labor, oil and misc. .... | 1,050 00 |
| Coal ..... | 4,500 00 |
| | 900 00 |
| Water ..... | 216 00 |
| | 43 00 |
| Total ..... | $8,584 00 |

During the year there is developed 3,000×200=600,000 K.W.-hours, giving a cost per K.W.-hour of $8,584÷500,000 =1.431 cents per K.W. hour. In the same manner it is found that when the heating season is equivalent to only two months of full-load heating, the cost per K.W.-hour is 1.85 cents. For the same conditions when the price of coal is $5.00 instead of $4.00, the cost per K.W.-hour is 2.175 cents, and in this way the table shown was compiled.

### Charts.

From these data the charts of Figs. 1 and 2 were prepared. In Fig. 1 the cost of power in cents per K.W.-hour (average over the whole year) is plotted against the number of months that exhaust steam is used for heating, each line representing a different price of coal. With this chart in hand, we can study the influence of coal cost, length of heating periods, the influence of first cost, and also of percentage of that cost which should be charged off per year in order to take care of interest, depreciation, etc.

The chart may also be used to consider the cost of power in a plant where a low pressure boiler is already installed and must be replaced. The additional first cost of the high pressure boiler over and above the low pressure boiler, taking into account the fact that a boiler of higher capacity would be required, was assumed at $1,500. Assume that an entire new boiler would be needed costing $7,500. This would increase the additional first cost of the plant by $6,000 and the additional yearly charges by $900, making the total fixed charge $2,775. For 600,000 K.W.-hours per year, this would increase the fixed charge per K.W.-hour from 0.312 cent to 0.462 cent. The influence of this additional charge of 0.15 cent upon the cost of power with $4 coal, and when three months' exhaust steam heating is used, is therefore an increase from 1.75 cents to 1.90 cents per K.W. hour.

In the chart Fig. 2, the cost per K.W.-hour is plotted against the cost of coal in dollars per ton, and each line represents the cost for different lengths of heating periods. This chart is useful for investigating the effect of the price of coal and also the comparative effect of length of heating season and price of coal. For instance, the cost per K.W.-hour is practically the same, for an eight months' solid heating season with $4 coal, as it is with a two months' heating season with $2 coal. On reference to this chart, it will be noted that the costs exclusive of coal and water are considered separately—being plotted against load factor.

A load of 200 K.W. for 3,000 hours per year is considered as 100 per cent. load factor (although the plant capacity is 250 K.W.), At 100 per cent. the fixed charges, labor, etc., per K.W.-hour are 0.488 cent. Similarly at 50 per cent. load factor the cost per K.W.-hour exclusive of coal and water is 0.976 cent. By similar calculations, the complete curve is plotted, which may be used in connection with the curves at the right in order to study the cost of power un-

der various conditions. Suppose, for instance, that the load factor is 50 per cent., then the ordinate (a)—10.98 cent fixed charges, labor, etc.; if the coal cost is $4 a ton and the number of months of exhaust steam heating is 4, then the coal and water cost per K.W.-hour is given by (b) as 1.17 cents and the total cost of power per K.W. hour is a×b= 2.15 cents.—From a report by the American Engine Co., Bound Brook, N. J., in Industrial Engineering.

## "ECONOMY" 16-INCH DOUBLE BACK-GEARED ENGINE LATHE.

THIS lathe conforms strictly to the new demands and conditions of modern shop practice. It is rigid and powerful, representing the highest standard of workmanship and design, while its special features are applicable to a wide range of work; making it, therefore, a most convenient and practical tool.

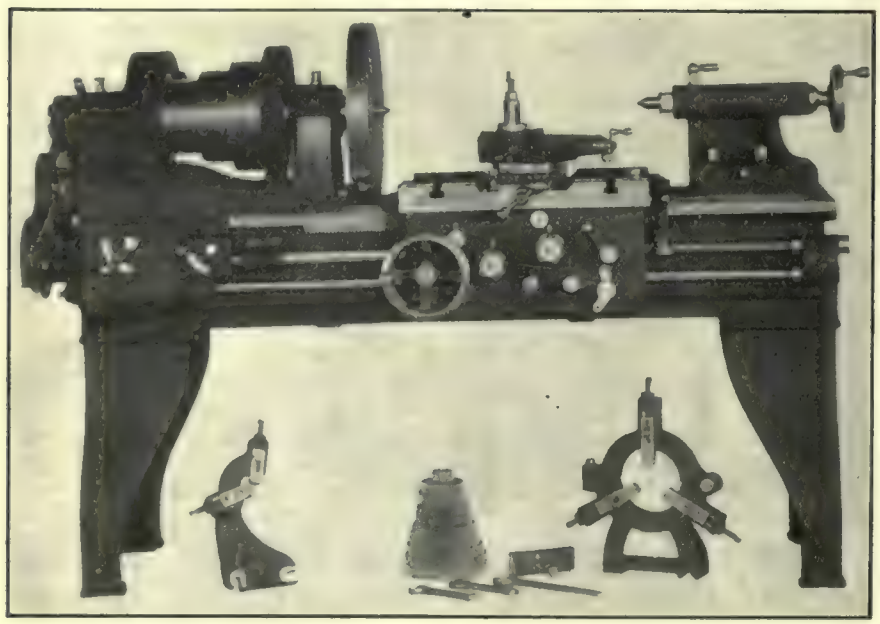
The bed is of deep section, with wide cross braces, which, together with a thorough distribution of metal, eliminates all vibration under heavy duty. The headstock is massive and firmly bolted to bed; the bearings, exceptionally large, are of the best quality babbitt, and the spindle of high carbon steel, accurately ground, has a 1½ inch hole its full length, permitting draw-in collets up to 7-8 inch capacity.

The tailstock, of the off-set type, allows the compound rest to set parallel to the bed, and is provided with set-over for turning tapers. Double clamping bolts ensure the tailstock being kept in position without slipping. The carriage is especially heavy with extra wide bridge which permits a heavy cut without chatter. It has a bearing of 26¼ inches on the ways, and is provided with self-oiling felt wipers. The thread cutting indicator, which can be disengaged when not in use, will be found a valuable feature when cutting long threads. The apron is of heavy design, with double bearing for all shafts; this is a very essential feature for heavy duty lathes. The gears are of wide face and coarse pitch. and, being cut from steel, withstand the constant strain without breakage, and with small wear. All feeds are reversed in apron, and interlock with lead screw nut; making it impossible to engage feeds and lead screw at the same time.

The gear box is designed to combine strength with simplicity. Three quick changes of feed are obtained for each change of gearing through sliding steel gears and hardened steel clutches, which give a powerful drive and an unlimited range of feed for all classes of work. This gear box simplifies thread cutting; all pitches being obtained without the troublesome compounding of gears, which has always been a great disadvantage of change gear machines.

The double friction countershaft has pulleys 12-inch diameter for 4-inch belt. The speeds are forward, 200; backward, 250, r.p.m. The regular equipment includes steady and follow rests, large and small face plates, full set of change gears, countershaft, and wrenches; while at extra cost, draw-in attachment and collets, taper attachment, turret on carriage and turret on shears with or without power feed, are furnished at extra cost.

The lathe is manufactured by the Rockford Lathe and Drill Co., Rockford, Ill.



Rockford 16-inch Economy Lathe.

## R. J. LEVY A TITANIC VICTIM.

Mr. R. J. Levy, manufacturer of oxygen and proprietor of various oxy-acetylene welding and cutting equipments at Montreal, is believed to have lost his life through the disaster to the White

THE LATE R. J. LEVY.

Star steamship Titanic. Mr. Levy, who is also an expert chemist, left Montreal early in March of this year on a business trip to London and Paris. He wrote his family, stating that he was returning by that vessel as a second-cabin passenger. Mr. Levy was 35 years of age, and in a brief space of time had become prominent in the development and progress of oxy-acetylene cutting and welding throughout the Dominion.

## AMERICAN FOUNDRYMEN'S CONVENTION.

The date of the 1912 convention of the American Foundrymen's Association, has been definitely set for the week of September 23. As previously announced, Buffalo, N. Y., is the place of meeting, and following the practice of former years, the Foundry and Machine Co. Exhibition, the American Institute of Metals and the Associated Foundry Foremen meetings will be held there concurrently.

The A. F. A. have selected the hotel Statler as their headquarters; the F. and M. E., the Hotel Lafayette, and the A. I. M. the Hotel Iroquois.

**Mr. Valentine Boyd**, recently on the staff of the Canadian General Electric Co., Toronto, has joined the staff of the Canada Machinery Corporation, Galt, as assistant to the general manager.

# Industrial and Construction News

### FOUNDRY AND MACHINE SHOP.

**Craik, Sask.**—There is now under construction here a machine shop which will be up-to-date in every particular. The building will be forty feet wide and sixty feet long; one end will contain the forge, while the other will be used as a garage. Harvie Hawes from Toronto is the machinist.

**Woodstock, Ont.**—City Clerk Morrison has declared the by-law carried, granting aid to the Woodstock Automobile Company. Thus, the activity of the company will eventually follow.

**Saskatoon, Sask.**—J. A. McMillan and T. W. Renwick have formed a company capitalized at $50,000 and to be known as the Saskatchewan Motor Works Co., Ltd.

**Ingersoll, Ont.**—The ratepayers ratified the by-law to expend $125,000 to cover the cost of buying the plant of the Ingersoll Waterworks Company.

**Walkerton, Ont.**—The voters recently passed a by-law to raise $10,000 to aid the manufacturing of harness and vehicles.

**St. Catharines, Ont.**—The Reo Motor Car Company of Canada are contemplating enlarging their present plant in this city to over double its present capacity of 600 cars per annum.

**Sumas, B. C.**—The result of a conference recently held between the officials of the International Lime Company of Kendale and the business men of Sumas was that it was decided to move their headquarters from Seattle to Sumas. This change is owing to the Kendale plant not being up to the demand and it is the intention to increase the output of the plant immediately.

**Okotoks, Alta.**—Within a month or two, work will be started on the building of a railway to the properties of the Alberta and Canada Iron syndicate, 25 miles west of here. When the railway is completed, a mill will be erected and iron will be mined. The whole project will cost about $5,000,000. P. Burns is behind the venture.

**Ipswich, B.C.**—It has been announced that a factory for the production of Diesel engines is to be established at this place and will cost $240,000. The Diesel Company have obtained an option on a site belonging to the Ipswich corporation.

**London, Ont.**—The Street Railway Company, Manager C. B. King, will equip a car repairing plant and will purchase all necessary machinery. The cost will be $7,000.

**Port Colborne, Ont.**—A by-law was passed recently to grant concessions for a steel and iron smelter plant to cost $1,000,000 for The Union Furnace Co., Buffalo, N.Y. The subsidiary owners are Canadian Furnace Co. of Port Colborne.

**Chatham, Ont.**—The recent by-law, providing for a machine plant to cost $100,000 for the St. Mary's Machine Co., of Ohio, of whom D. Anderson is manager, has been carried. The company will occupy the premises vacated by the Swift Motor Car Co. A new equipment will be required and Mr. Anderson will superintend the installation which will commence at once.

**Galt, Ont.**—A new plant for the manufacture of lathes, planers and other machine tools will locate here. Mr. Wm. Preston is looking after the new plant. A complete new equipment of machinery will be required.

**Guelph, Ont.**—C. J. Furber & Co., will equip a new factory for the manufacture of metal weather stripping screens and ventilating appliances. New machinery and equipment will be required.

**Hamilton, Ont.**—A construction plant to cost $200,000 is under consideration by the American Locomotive Co., 30 Church St., New York City.

**Owen Sound, Ont.**—A new grain elevator to replace the old elevator recently destroyed by fire is being contemplated by James Playfair of Midland. Complete loading and unloading facilities will be installed. The cost will be about $100,000.

**London, Ont.**—Manager C. B. King, of the street railway, states the company will equip a car repairing plant for which all necessary machinery will be purchased. The cost will be about $7,000.

**Brantford, Ont.**—A report states that the American Radiator Co. will erect an important addition to their plant. The extension will be about 750 feet in length.

**Welland, Ont.**—The management of the Welland Machine and Foundry Co. will erect a new foundry, a paint shop and storehouse and will install one or more travelling cranes.

**Regina, Sask.**—The management of the Cockshutt Plow Company have let the contract for

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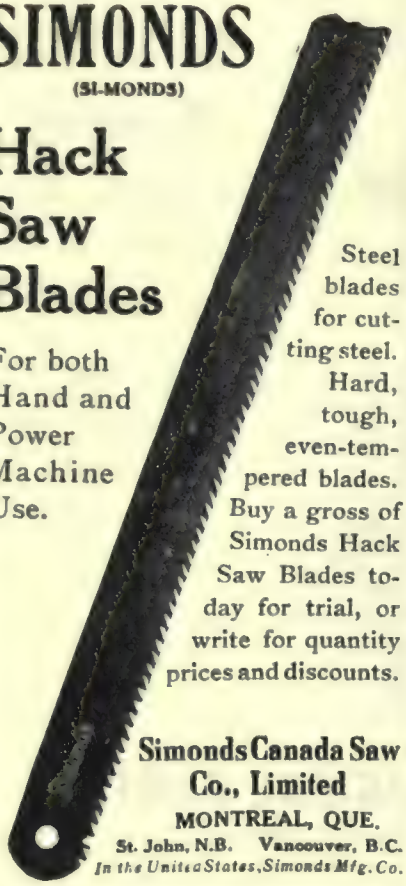
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No work too big for us.
The Pontbriand Marine Engine has been local standard for 40 years.
12 stock sizes of Marine Engines.
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the erection of a new factory in this city. It will consist of three stories and a basement constructed on the property owned by the company in Block 77 with a frontage of 150 feet on Broad Street, and 100 feet on Fifth Avenue. The plans include two large-sized heavy capacity freight elevators. The total cost is estimated in the neighborhood of $120,000.

**Vancouver, B.C.**—The Standard Iron Works, of Vancouver, B. C., began business on March 15. The works are conveniently located on the water front, with the railroad on one side and a wharf on the other. A general boiler, tank and sheet iron business will be carried on. The shop equipment is of the very latest design, and was installed with the idea of handling large jobs. The young men behind this enterprise are thoroughly equipped, and we predict a bright future for them.

**New Glasgow, N.S.**—The Canadian Bridge Company have recently purchased a large stock of shares of the Wm. P. McNeil Company, New Glasgow, Nova Scotia. Mr. K. W. Bash has been appointed vice-president and engineer, and Mr. W. McNeil is the president and manager of the new company. Extensive improvements were made to the plant during the past year, resulting in well-equipped works for the manufacture of structural steelwork and further improvements are anticipated in the near future. Other than the changes noted above, the policy of the company will remain intact.

**New Westminster, B.C.**—The Schaake Machine Works Co. are about to build a new and much larger plant here.

### MUNICIPAL.

**Ormstown, Que.**—A by-law will shortly be submitted for ratification to raise $52,000 for waterworks and sewers system.

**Calgary, Alta.**—On May 3rd the burgesses will vote on a by-law to raise $300,000 for the construction of a drainage system.

**Weyburn, Sask.**—The burgesses will vote on a by-law to authorize the expenditure of $25,000 for a sewerage system.

**Melville, Sask.**—Among the several by-laws about to be submitted to the burgesses for ratification is one calling for the raising of $3,300 for a power house.

**Dunnville, Ont.**—The council is contemplating submitting a by-law to authorize the borrowing of $10,000 as a bonus to the Sewsure Manufacturing Company.

**Vernon, B.C.**—Concerning the reported purchase of the Coteau Power Company by Mackenzie and Mann (C.N.R.), and the burning of the power plant in this city, it is now reported to be unlikely that the city will build again, but will arrange with the Coteau Power Company for a supply of light and power.

**Comber, Ont.**—The ratepayers of the Township of Rochester are contemplating voting on a by-law to raise $1,140 to cover cost of drainage work.

**New Westminster, B.C.**—A by-law will soon be submitted to authorize the raising of $40,000 for waterworks.

**Windsor, N.S.**—The burgesses will shortly vote on a by-law to raise $75,000 for sewerage system.

**St. Catharines, Ont.**—The burgesses will probably be asked to vote on by-law to raise $40,000 re construction of new sewers.

**Montreal, Que.**—The ratepayers will shortly have the opportunity of authorizing the expenditure of $400,000 for new sewers, sidewalks and water mains.

**Vernon, B.C.**—The burgesses will be called upon to vote on a by-law to raise $40,000 for waterworks extension; also a by-law to raise $7,500 for municipal building.

**New Westminster, B.C.**—The ratepayers have voted $400,000 for road and waterworks extensions and city enterprises.

**Saskatoon, Sask.**—A by-law is being prepared calling for the borrowing of $220,000 to cover cost of abattoir system.

**Kelowna, B.C.**—A by-law will soon be submitted to ratepayers to sanction the raising of $7,000 for water system.

**Township of Tilbury West, Ont.**—A by-law is about to be submitted to the ratepayers for the raising of $3,914.25 re cost of drainage in the townships of Rochester and Tilbury North.

**Point Grey, B.C.**—It is probable a by-law will soon be submitted to the ratepayers to raise $187,710 re water supply.

**Windsor, N.S.**—The burgesses are contemplating voting on a by-law to raise $75,000 for sewerage.

**Swift Current, Sask.**—The ratepayers will be asked to vote on a by-law to raise $10,000 for publicity work.

**Fergus, Ont.**—The ratepayers passed a by-law to raise $35,000 for a waterworks system.

**St. Catharines, Ont.**—A by-law to aid, by fixed assessment, a company being formed by H. B. Stone, of Warren, Pa., a shareholder of the Warren Axe and Tool Company, will be voted on by the ratepayers soon.

# A Radial Drill that will by foot power drill holes up to one inch without a pilot hole, at the speed of an inch in six minutes; with slotted wings for awkward work, inexpensive, but one of the most useful tools ever designed.

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|---|---|
| Surface of table top - | 23″ x 12″ |
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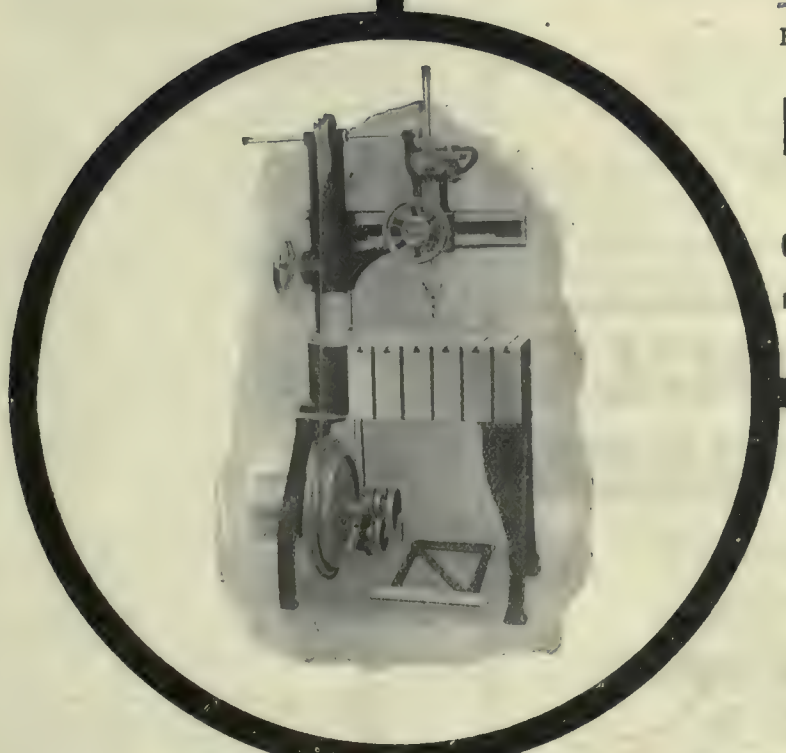
| Travel of head on arm - | 18″ |
| Arm will rise and fall - - | 6″ |
| Sensitive movement - - | 4½″ |
| Radial movement of arm - | 120° |
| Height over all - - | 5′ 10″ |
| Weight - - - - | 720 lbs. |



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***DIES AND TOOLS***
***POWER PRESSES***
For Rapid Production of Sheet Metal Stampings
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**Toronto, Ont.**—The finance committee of the Board of Education has accepted the following tenders:—Duke of Connaught School: masonry and steel work, $53,200, J. Bayfiss and Son; terra cotta, $6,608, Robert Bennett; carpenter work, $22,545, William Williamson; plastering, $5,294, George White; painting, $2,630, J. R. Robinson; roofing and tinsmithing, $2,021, W. E. Dillon and Co.; iron stairs, $4,500, Dominion Ornamental Iron Co.

**Regina, Sask.**—The following contracts have been awarded by the city council:—Seventh Avenue trunk sewer, $41,133.70, Canadian Lock Joint Pipe Company; Wascana Valley trunk sewer, No. 1, $29,631.04, American Sewer Pipe Company; Wascana Valley trunk sewer, No. 2, $20,585.20, Broley and Dickson, of Fernie, B.C.

### ELECTRICAL.

**Regina, Sask.**—The burgesses voted on several by-laws recently, and among those carried was that to raise $83,000 for an electric light and power system.

**Penticton, B.C.**—The ratepayers will vote soon on a by-law to raise $20,000 for electric light extensions.

**Fort Frances, Ont.**—The ratepayers voted in favor of a by-law to grant a bonus of $25,000 to the Ontario and Minnesota Power Co.

**Brantford, Ont.**—The city council has been advised to submit a by-law involving an outlay of $109,000 for the installation of a hydro-electric system.

**Brockville, Ont.**—A by-law empowering the town council to enter into an agreement with the Hydro-Electric Commission for a supply of power for the town was carried by a good majority when submitted recently.

**Vernon, B.C.**—The ratepayers will shortly vote on a by-law to raise $40,000 to cover the cost of the electric lighting system about to be installed.

**St. Mary's, Ont.**—The ratepayers propose to spend $5,000 for electric power purposes.

**New Westminster, B.C.**—Among by-laws voted upon recently and passed was one to raise $25,000 for electric lighting purposes.

### PLANING MILL AND SAW MILL.

**Midland, Ont.**—A by-law was passed by the ratepayers recently granting a loan of $25,000 to Benson & Bray for the erection of a planing mill.

**Chicken Lake, B.C.**—A sawmill is about to be installed at this place, capacity 15,000 feet daily.

**Robert Marr**, of Princeton, B.C., is erecting a sawmill to cut 35,000 daily.

**New Westminster, B.C.**—The Schaake Machine Works, of this place, are about to build a new and much larger plant here.

**Vancouver, B.C.**—The Britannia Mines Co. will in the near future install a new hydro-electric plant. It is said this plant will operate under the highest head to date in Canada, at 1,800 feet.

**Vernon, B.C.**—This town is negotiating with the Couteau Power Company for a supply of electric power.

**Wheatley, Ont.**—It is reported that complete new machinery for an electric light plant will be installed.

**Wetaskiwin, Ont.**—The by-laws to expend $39,000 on waterworks and power plant both carried.

**New Hamburg, Ont.**—Electors will vote on a by-law to loan $20,000 to an industry which will manufacture electrical supplies here.

**North Battleford, Sask.**—The proposed addition to the electric light plant will involve an expenditure of about $30,000.

**North Battleford, Sask.**—Tenders have been called for a 750 h.p. engine and 500 k.w. generator.

**Quebec City, P.Q.**—The Dorchester Electric Company have announced that they will have a steam plant in operation by the first of November, and that later they will build a hydro-electric plant and keep their steam plant as a reserve.

**Thorold, Ont.**—The Montrose Paper Company are asking tenders for 36 motors aggregating 900 h.p. and other equipment.

**Verdun, Que.**—The town council has passed a by-law to provide $229,000 for increased fire protection, extension of water, filtration and electric light plants, and for water mains, sewers and general improvements.
HAMBLIN—C M

### BUILDING NOTES.

**Fort Frances, Ont.**—It is reported that a Winnipeg company is about to build a large departmental store, and that the Hudson Bay Company is behind the movement. The report, however, has not been confirmed.

**Montreal, Que.**—The new Alexander St. structure to be built this summer will be the largest building in Canada. It will be known as the "Read Building," and will cost about $1,000,000.

**Winnipeg, Man.**—Stores Commissioner Burbidge, of the Hudson's Bay Company, states that work has begun on the Calgary store, which will cost $1,500,000. A $25,000 garage is also being built. At Yorkton a $50,000

store will be erected this summer. The steel work in the Calgary store has been awarded to the Dominion Bridge Co., Montreal.

**Saskatoon, Sask.**—Plans are now being prepared by Thompson, Daniel and Colthurst, architects, for a new $150,000 hotel building.

**Montreal, Que.**—The McGill Property Syndicate obtained a permit to erect an eight-storey office building, to cost $300,000. R. E. Bostrom is architect, and C. E. Deakin builder.

**Lethbridge, Alta.**—The board of trade announces that a $300,000 hotel will be erected immediately. Messrs. Paul, Falver and J. F. Davis, of Calgary, are behind the enterprise.

**Toronto, Ont.**—The old Bay Street firehall property has been leased to Norman G. Heyd and A. H. Sarrett. The firehall will be torn down, and in its place a 10-storey office building is to be erected, the cost of which will be about $260,000.

**Calgary, Alta.**—The contract for the erection of the new King George School was awarded to Jones and Lyttle, at $125,620. The heating and plumbing contract was given to Grant Bros., at $21,850.

**Vancouver, B.C.**—Plans are completed for the new central building, which is to be erected on Granville St. The building will be 18-storey high, and will contain 54 rooms in all. The property was bought for $400,000.

**Fort William, Ont.**—It is announced that four 4-storey wholesale houses will be built this year. The promoters are Cameron and Heap; Matthews, Lang Co.; Fife Hardware Co., and Fitzsimmons Fruit Co.

### TRADE NOTES.

**The Smart-Turner Machine Co.** have recently secured the following orders:—The Port Dover Brick & Tile Co., Port Dover, Duplex Pump; The Stouffville Cider and Vinegar Co., Stouffville, Ont., No. 1 Side Suction Centrifugal Pump; J. C. Wilson & Co., Lachute Mills, Que., Simplex Power Vacuum Pump; Capt. R. Gavin Dredge "Industry," Collingwood, Ont., Duplex Packed Piston Pump; The Coniagas Reduction Co., Thorold, Ont., Side Suction Centrifugal Pump; The Penman Mfg. Co., Brantford, Ont., Triplex Power Pump; Messrs. Chappell Bros., St. Omer, Que., Duplex Packed Piston Pump; The Hollinger Gold Mines, Ltd., Timmins P.O., Porcupine, Ont., Duplex Pump.

**Messrs. Wailes, Dove & Company's** "Bitumastic" Solution and Enamels have been adopted for painting the whole of the Gates and Structural Steel work in connection with the Panama Canal, at a cost of $335,000.00, probably the largest individual contract ever given for painting. Machan & Hebron, St. Francois Xavier St., Montreal, are the Canadian representatives.

**Montreal, P. Q.**—Tenders have been invited by the Cedar Rapids Manufacturing and Power Co., Montreal, for the first section of their power scheme. This will comprise the construction of the dyke and part of the power house, at an estimated cost of about $2,000,000.

**St. Jerome, P.Q.**—Tenders have been awarded for the hydro-electric system at St. Jerome, P.Q., as follows:—Transmission and distribution, Marchand & Donnelly, Ottawa, $10,875; generators, Swedish General Electric Company, Montreal, $5,475; switchboards, Hill Electric Switch & Manufacturing Company, $3,496; water wheels, William Hamilton Company, Peterborough, $4,743; penstock and concrete work, Laurentian Construction Company, Montreal, $33,814. The generator equipment consists of two 150 k.w., 4,000 volt, 327 r.p.m. waterwheel type units with direct-connected exciters supplied through the manufacturers' Canadian agents, Messrs. Kilmer, Pullen & Burnham, Toronto.

**Calgary, Alta.**—The city of Calgary has awarded a contract for a 2,500 k.w., 60-cycle, 3-phase, 2,300 volt turbo-generator. The complete equipment is being supplied by Messrs. Laurie & Lamb, of Montreal, and will consist of a Belliss & Morcom steam turbine, a Vickers, Limited, alternator, as well as an air pump, the necessary piping, etc.

**Calgary, Alta.**—The corporation of the city of Calgary have placed an order with Messrs. Killmer, Pullen & Burnham, Ltd., for one 1,000 k.w., 400 r.p.m., synchronous, self-starting, railway motor-generator set, manufactured by the General Electric Company of Sweden, to be installed in their new substation on Ninth Avenue west, city of Calgary.

**The Davidson Electric Company** have established themselves at 174 Notre Dame Street east, Winnipeg, where a general contracting and supply business will be carried on. This company will also specialize in the repair and maintenance of fine electrical instruments. The new firm is composed of Jas. A. Davidson and Chas. E. Long, both practical electricians of many years' experience.

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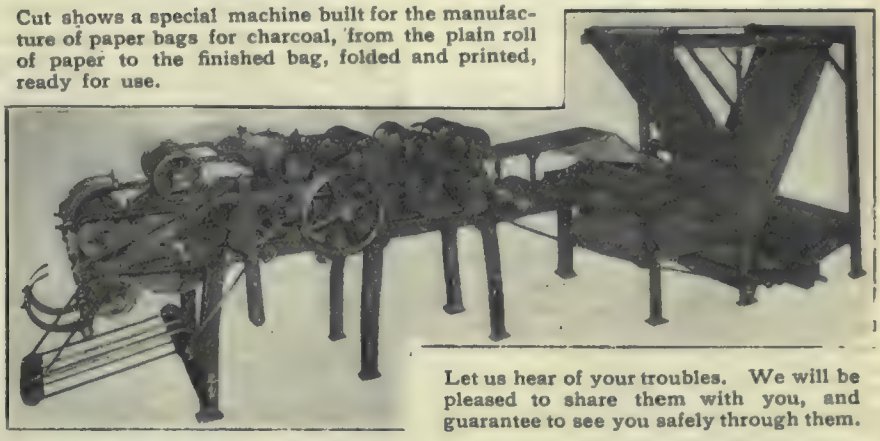

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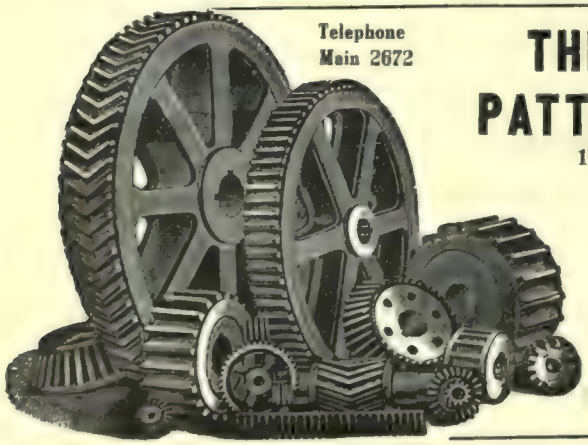


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ending December 31, 1911, shows that the net profits were $1,010,153, being an increase of 45 per cent. over the best previous year. The total assets of the company now amount to $6,586,751. Extensions to the plant have been an important factor during the past year. The extensions to the warehouse, factory and pattern building were completed early in 1911, and the plant has been further increased by the new main machine shop aisle now nearing completion, after which the necessary machine tool equipment will be installed. The former boiler plant has been rebuilt with all labor-saving appurtenances, and in such a way as to permit of the installation of extra units as required. The construction of all these buildings has been carried out on lines of solidarity and permanency.

### GENERAL MANUFACTURING.

**Duck Lake, Sask.**—A by-law will shortly be submitted to raise $3,000 as a bonus to the Dominion Milling Company which is about to start up here.

**Port Arthur, Ont.**—W. Scott, of the Pigeon River Lumber Company contemplates the establishing a pulp mill at this place and has asked the city council for supply of power up to 2,000 horse power.

**Ottawa, Ont.**—Fire in the building occupied by Hugh Carson, Ltd., trunk and valise makers did damage to the extent of $7,000. The loss is covered by insurance.

**Bowmanville, Ont.**—It is very probable that a new manufacturing industry will be located here. If present plans are carried into effect it will employ 400 to 500 hands, male and female. Details are not given.

**Port Colborne, Ont.**—The Robinson Bros. cork factory was partially destroyed by fire recently. About 6,000 square feet of corkboard, the machinery and belting were completely destroyed.

**London, Ont.**—T. Dexter & Son are considering the purchase of property and enlarging present flour mill or else constructing an entire new mill at a cost of $40,000.

The Battle Creek Breakfast Food Co., Dundas street, have had plans prepared by architects Moore & Munroe for erection of a factory; 4-storey and basement, 50 x 100, modern in every detail. Cost $25,000.

A company is being formed to equip a chain of ten cent stores all through the district and a charter will be applied for at once. Complete store fittings and equipment will be needed. Address F. H. Brewster, London.

Plans are being prepared for biscuit factory to cost $250,000, for D. S. Perrin & Co. Architects, Moore & Munroe, London, 6-storey, stone foundation, brick construction, steam heating, electric light, gravel roofing. Biscuit, box and candy making machinery required. Elevators and boilers required.

Ald. Hubert Ashplant has plans prepared by architects Moore & Munroe for erection of sample rooms on Carling st., 5-storey, 33½ x 75, stone foundation, steam heating, electric lighting, gravel roof, telephones, elevators and modern fittings for 30 sample rooms will be required. Tenders received by Moore & Munroe. Cost $25,000.


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# The Cincinnati Milling Machine Company's New Plant

By C. T. R.

*The impression that a visitor gets when taking a trip through this plant is, that here are shops on which an immense amount of thought was expended to secure, as nearly as possible, ideal conditions in regard to light, heat, ventilation, sanitation, and all that goes to make the life of the workmen more pleasant; in other words, a plant constructed and equipped for the highest efficiency.*

THE new shops of the Cincinnati Milling Machine Co., Cincinnati, Ohio, were planned some years ago when the company's business had grown beyond the capacity of the old equipment.

During the search for a new location, Mr. Fred. A. Geier, President, conceived the idea of a factory colony, grouped about a central power plant. He secured options on a 100-acre tract, ideally located as to topography, railroads, street cars and labor. Three other companies who were in need of better facilities, at once joined in the original project, and formed a real estate development company, which assumed the work of laying out streets, railway connections, sewers, etc. The central power plant is managed by a separate company, whose stock is owned by the various plants served, now numbering seven. It furnishes power, light, heat, compressed air, water, sprinkler service, etc.

The Cincinnati Milling Machine Co.—Gear Cutting Department.

The Cincinnati Milling Machine Co.—Drill Press Department.

The Cincinnati Milling Machine Co. retained seventeen acres for foundry and machine shop purposes. The first buildings were erected in 1907, and formed the present plant of the Modern Foundry Co., which is owned by the stockholders of The Cincinnati Milling Machine Company. It has a daily melting capacity of thirty tons of iron for machine tool castings, all of which, including the largest milling machine column castings, are made on molding machines. Its practice includes a number of processes which have been developed to produce castings of high quality, for each of the important parts of their milling machines.

The first section of the machine shop was erected in 1909 and 1910, and was

The Cincinnati Milling Machine Co.—Bird's-eye view of the plant. 275,000 sq. ft. floor space (exclusive of power plant).

operated in connection with the old plant, until the final three-storey section was ready for occupancy in the Fall of 1911. The machine shop proper is a single-storey brick and steel building, 16 feet high under the trusses and 26 feet under the peak. A 60-foot section

The Cincinnati Milling Machine Co.—Ch ucking Lathe and Automatic Department.

along the eastern length of the building is 21 feet under the trusses, and is traversed by five-ton traveling cranes. The roof is concrete and steel, covered by Carey roofing. It is supported by hollow cast iron columns of such small diameter that there is an absence of that sense of obstruction which is sometimes present in shops using built-up steel columns. They are hollow, and also serve as downspouts. The roof trusses are provided with gusset plates to facilitate placing countershafts and craneways in either direction. The cuts show some of them in use carrying the beams from which motors are suspended. The floor is concrete, re-inforced, 8 inches thick, making individual foundations for machines, except in the cases of the largest planers, unnecessary. It also provides that stability for the testing and assembling departments, which is so essential for satisfactorily doing this work. That part of the shop which is occupied by the planers, has a floor 12 inches thick, to carry the weight of the smaller planers and the masses of heavy material in process of manufacture grouped around them.

In preparing the ground previous to laying the concrete floors, the sod was all removed and the surface rolled with a 10-ton roller; then levelled and rolled a second time. A covering of tar felt was placed over the entire surface to hold out moisture, and the concrete was placed directly on this covering. The re-inforcing consists of ½-inch twisted bars laid at right angles to each other, placed 12 inches apart and wired together at all intersections; thus making the entire floor a monolith. This style of floor proved so satisfactory during more than a year's experience in the first part of the building that it was unhesitatingly adopted for the final addition recently completed.

The south front of the building is three stories of re-inforced concrete, monolithic construction, faced with brick. The upper floors are 60 feet deep by 380 feet wide. The first floor is a continuation of the one-storey shop, forming an unbroken L-shaped room, 380 feet by 585 feet. The purpose in adding two upper storeys over this part of the building was to provide suitable quarters for the various offices, and space for those departments which earlier experience proved, should preferably be separated from the main machine shop.

**Offices.**

On the third floor are located the offices, the engineering and clerical departments. The upper floor was selected for offices, because of the desirability of having them on the floor highest above the ground level on account of being quieter, cleaner and airier. They occupy the central part of this floor.

The floors of all the offices, as well as the floor of the main entrance to the building, are laid with ceramic tiling and there is a 6-inch sanitary base of green tile; the whole producing not only a durable and sanitary effect, but also a very pleasing ornamental effect. Access to the offices is by means of an elevator. The western end contains an auditorium having seating capacity for 600 people. There is also provision for a kitchen and dining rooms. Immediately adjoining the engineering section on the east is the tool-making department, which brings it in close touch with the tool-designing department.

The second floor is devoted to stock-rooms for finished details, and for as-

The Cincinnati Milling Machine Co.—Engine Lathe Department.

sembling cutter grinders, dividing heads and other attachments. This is the only manufacturing done outside of the main machine shop floor; the tool and jig-making department on the third floor being in no sense a part of manufacturing. This portion of the second floor was set aside for this purpose solely to provide a place where the dividing heads could be assembled as a specialty, this being precision work; and experience has shown that it can be accomplished more satisfactorily in an isolated department.

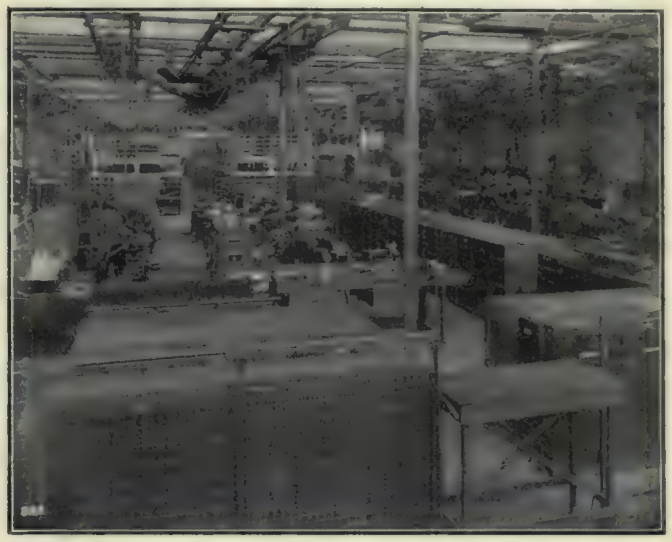
Cooper-Hewitt mercury vapor lamps, which furnish sufficient illumination for all purposes without the use of incandescent lights except in a few very special cases. The offices and engineering departments are lighted by the indirect system, using Tungsten lamps in clusters. This soft, diffused and evenly distributed light, with its entire absence of glare and shadows, is proving as satisfactory as good daylight conditions.

**Heating.**

The buildings are heated by the Evans-Almirall system of forced circulation hot water. In the saw-tooth, single-storey part of the bulding, the circulation pipes are placed on the lower cords of the trusses immediately below the window space. This arrangement warms the cold air descending from the roof windows, and prevents all discomforts from drafts caused by descending currents of cold air from these windows.

highly specialized and many machines are specially fitted up for certain work. There are also many machines which have been designed and installed mainly to improve the quality of the work. Some extremely large bar work is done on automatics, the largest machines of this type taking bars 6 3-4 inches diamter. Individual motor drives are largely used, and wherever possible, the motors are mounted directly on the machines. In some cases, however, this has not been found desirable, and the motors are mounted on the ceiling directly over the machines. Next to the lathe department comes the grinding department, and next to this are the thread-milling and screw-chasing machines. In this latter section all short screw threads are milled, while the long lead screws are done entirely on automatic thread-chasing machines. Each lead screw is carefully tested for accuracy for every six inches of its length.

The Cincinnati Milling Machine Co.—Tool-Making Department.



The Cincinnati Milling Machine Co.—The Tool Room.

**Employees' Conveniences.**

The employes' entrance is on the Columbia Road side and leads directly into the service room. Ventilated steel individual lockers are provided for each man. The wash basins are of the individual type, with hot and cold water, and in such numbers as to provide one basin for every three men. Hot water for this room, the shower baths and all the lavatories in the offices, is obtained by instantaneous heaters. The service room also contains a large toilet room, similar to those distributed at intervals throughout the plant. They are marble-lined, with marble stalls, and all the metal work is nickel-plated. The entire room is kept in a highly sanitary condition. The side walls have a space of clear glass above a line 4 feet from the floor. Adequate ventilation is obtained through a 4-inch opening all around the bottom between the side walls and the floor, and a suction ventilating fan at the top. The shower baths are for the use of all employees. They are built of marble; each space being divided into two sections; the bath in rear and a dressing room in front.

**Lighting Equipment.**

All the manufacturing departments are lighted by an ample installation of

**Ventilation.**

The provisions for ventilating have also had a sufficient test during the extremely hot weather of last summer, when they proved entirely adequate; the shop having been held at a comfortable temperature and with an ample amount of fresh air at all times.

**Foundry.**

The foundry is located to the north of the machine shop, with which it is connected by means of an industrial track. A depressed railway siding connects with this same industrial track, over which all raw materials enter the north end of the building.

**General.**

The various departments are located in relation to each other in accordance with the sequence of operations, the first operation machines being at the north end of the building where the material enters. The equipment in general is

Adjacent to the thread-millers are the gear cutters. This latter equipment includes a Gleason bevel gear generator and two special tooth-rounding machines shown on the right foreground. These have been designed and built to meet this company's special requirements. They have a capacity for rounding the teeth on 16 inches diameter, 2 1-2 pitch drop forged steel gears. All gears are tested on fixed centers, the theoretical distance apart, and the gears cut as closely as possible to the theoretically correct dimensions. A 20-degree pressure angle form of tooth has been adopted because of its greater strength, and the cutter for each gear is specially developed for the number of teeth for that gear. Proper running clearances between the gears are provided in the finished machine by arranging their final center distances, a few thousandths

farther than the correct figured distance apart.

### Tool Room.

The tool room is located as nearly as possible centrally in the main manufacturing department and comprises a floor space of 28 ft. by 200 ft. All jigs, tools, and fixtures except some very large ones are kept in this department. Every part entering into a machine bears the number of its drawing, and this same number will apply to the pattern jig drawing, jig, tools, instruction sheet, and in fact every tool of any kind that is used in its manufacture.

The tools and jigs are listed on a card index, and each card lists all the tools of every kind used for that operation, and also gives their definite location on the shelves. These cards, bearing the part number of the piece, are arranged numerically by these numbers, thus forming a direct and quick finding system, and facilitating the immediate location of the jig itself.

This is, distinctly a storage and distributing room, neither tool-making nor repairing being done. All cutting tools, however, are sharpened here immediately upon their return from the manufacturing departments, and before being again placed on the shelves. Every tool, jig and fixture is inspected after having been used, and if in need of repairs is sent to the tool-making department. All standard small tools, such as drills, reamers, gauges, etc., are kept in cases.

### Inspection.

Immediately adjacent to the tool room is the inspection department. Here all details are inspected after each machining operation. The inspection is by micrometers, clock indicators, running centers and fixed gauges. All hardened gears and clutches and similar parts are tested under the scleroscope; definite standards of hardness having been determined upon for each part. The routing department is also located here. The large charts contain a record of every piece passing through the shop, indicating which department it is in, and, therefore, which operation is being performed on it, and also the date when each successive operation must be finished. In this way absolute control is kept over the movements of every individual piece. Upon passing the final inspection, finished parts are delivered to the stock room, where they are placed on shelves and await withdrawal for assembling.

### Routing of Castings.

All the large castings when entering the north end of the building are carried by the industrial track to the planing department. The planers are each driven by individual motors. A number of them have 40 ft. beds, the largest of which is 72 inches x 72 inches x 40 feet. They are provided with a variable cutting stroke, and a constant return stroke of 100 feet per minute. After leaving the planers, the castings pass to the drilling, milling, or boring departments.

### Arrangement of Machines.

Machines are all grouped according to size and with regard to the nature of the work to be done on them; the larger units being located under travelling cranes. The smaller machines, facing the jib cranes to facilitate swinging large castings, are belt driven and arranged in two parallel rows.

### Assembling System.

The construction of the new model milling machines is entirely on the unit system. Each group of mechanism, such as feed boxes, drive boxes, driving clutch pulleys, reverse boxes, etc., being a complete unit in itself. The final assembling, therefore, is merely the gathering of these units into a complete machine.

The machine finally arrives in the finished testing department, and here it is given a thorough test for accuracy of alignment and proper operation of all details. Every machine is given a running test under belt a specified length of time, and must do a specified amount of milling successfully before it passes inspection. A permanent record is kept of all the tests.

Adjacent to the testing department, is the final painting and packing departments. There are two doors leading to the shipping platform, one being provided with a vestibule for the protection of this part of the shop during severe weather. The doors are closed by steel drop curtain fire screens, and are entirely surrounded by circulation pipes on the hot water heating system.

The shipping platform on the outside of the building is most conveniently adapted to its purposes. The cars are placed on a depressed track, bringing their floors on a level with the platform. Three cars may be loaded at one time. There is no crane service provided, because all shipments are made in box cars.

All the shops in this new colony are models of design and efficiency for the class of work done in them, and form a delightful field of information for anyone interested in machine shop processes and machine shop building construction.

---

A lathe can be run at about the same speed on Monel metal as on mild steel, although Monel metal is somewhat tougher.

## FORCED DRAFT SYSTEM SAVING.

THE New York Steam Laundry Co., of Montreal, recently effected a saving of $13.30 a day in their coal bill by installing a Venetian Blind Steam Blown Grate, being the Paillon System of Forced Draught. These grates replaced an automatic stoker, and were installed at the total cost of $375.00. Previously, the furnace required four tons of ¾ lump soft coal at $5.15 a ton. Now, only 2¼ tons of hard coal screenings, at $2.10 a ton, mixed with half a ton of ¾ lump soft coal at $5.15 is sufficient. It was also found that more steam could be produced, for, with the same boiler capacity there was sufficient steam to run the engine as well as the laundry. The engine had to be closed down some time ago on account of lack of steam, and a gas unit was installed. The gas unit is now used as a standby.

H. L. Peiler & Co., Montreal, installed the apparatus.

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## SPECIFICATIONS FOR BABBITT METALS.

THE Committee on White Metals appointed by the American Society for Testing Materials held a meeting in the Hotel Astor, New York City, on March 28th, and the following specifications for Babbitt metals were proposed:

1.—Commercially designated "Soft-Genuine," having the composition adopted by the Society of Automobile Engineers, Specification No. 17, Babbitt Metal No. 1.

2.—Alloy which is generally used in street railway service known as G. E. 17 alloy. This is closely analogous to Specification No. 18, Society of Automobile Engineers, Babbitt Metal No. 2.

3.—Intermediate grade of Babbitt metal, containing lead and copper.

4.—A true lead base Babbitt metal containing tin, which is analogous to many of the widely advertised brands of Babbitt.

5.—What is commercially known as No. 4 Babbitt, a straight lead and antimony alloy.

| No. | Tin. | Antimony | Copper | Lead |
|---|---|---|---|---|
| 1. | 89% | 7% | 4% | None |
| 2. | 83 1-3 | 8 1-3 | 8 1-3 | None |
| 3. | 50% | 12% | 1% | 37% |
| 4. | 7% | 17% | None | 76% |
| 5. | None | 10% | None | 90% |

In connection with these alloys it was proposed to make investigations upon the heat treatment of them.

The foregoing specifications are only tentative and were suggested by the committee as a working base for further discussion.

# National Fire Waste and Its Prevention

*Of the many problems, each demanding more or less prompt and effective practical attention by every individual and community, none is more pressing than that of prevention of the enormous life and material losses and desolation caused by the fire demon. The author of this paper discusses the subject quite frankly, and his suggestions and conclusions are such as to command careful consideration by all of us.*

COMBATING the stupendous waste due to fire, a loss that amounts to $30,000 every hour in the twenty-four each day throughout the year, was the theme of an address delivered on April 10 by Franklin H. Wentworth, secretary of the National Fire Protection Association, before the New England Foundrymen's Association, Boston.

As long as wooden cities stand, said Mr. Wentworth, disastrous fires with shocking losses of life are bound to occur. He declared, however, that the growing disposition to hold citizens personally responsible before the bar of public opinion for their carelessness is causing many of the most prolific sources of fire to disappear.

### Fire Insurance Rates.

Last year the legislatures of two States, New York and Illinois, undertook an investigation of the methods and practices of the fire insurance business. This procedure found its impulse in hostility toward the fire underwriting interests; but both of these investigations developed the fact that scientific or satisfactory underwriting is impossible, and will continue to be impossible until the criminally careless fire waste of the country is curtailed. It is obvious that these investigations and the one now under way in the State of Wisconsin represent an incoherent protest against the frightful impoverishment by the fire tax. The people feel that the fire tax is too high.

It is too high! Everybody knows that it is too high, but how can it be lessened except by attacking the cause of it? This is the question that every representative body must be forced to answer. The National Fire Protection Association has members in all walks of life, and this fact brings us close to the people and to their thought currents. We are engineers and special students of the fire waste, the social and economic results of which are often clearer to us than to the underwriters themselves. It is obvious to us that insurance rates cannot be reduced irrespective of the loss ratio without forcing insurance companies who mean honestly to pay their losses to retire.

Capital investment in underwriting is not so irrevocably fixed as capital invested in public service corporations using public property or rights of way. Such investments can be controlled easily by the State, but capital invested in underwriting can easily seek other channels and withdraw if the State imposes undesirable burdens upon it; thus leaving the business world without the necessary indemnity. The hopeful result of the legislative investigations I refer to is that the conclusions reached by them indicate that the State is not to waste many years in making and unmaking laws to find out that they have begun at the wrong end. Once the people realize that they themselves are being impoverished by the fire waste, they will be led to take such precautions as will soon result in a reduction of the fire tax.

### Individual and Universal Effects.

The fire waste touches the pocket of every man, woman and child in the nation; it strikes as surely but as quietly as indirect taxation; it merges with the cost of everything we eat and drink and wear. The profligate burning every year of $250,000,000 in the value of the work of men's hands means the inevitable impoverishment of the nation. What if we were to lose that sum annually out of the National Treasury, or in wheat, or corn, or cotton? A loss of $250,000,000 a year means $30,000 per hour for every hour of the twenty-four. We are burning the equivalent of a comfortable $5,000 home every ten minutes. This fearful loss, spread over the entire business world of America, is beginning to manifest its impoverishing blight. The people feel it without yet being awake to its cause. Their awakening is retarded by the prevalence of the foolish notion that the insurance companies pay this colossal tax; but how could they—and remain solvent? They are mere collectors and distributors of that portion of this tax which is represented by their policies. Half of it they never touch, it falls upon the householder direct. San Francisco and Baltimore do not pay for themselves. We in Massachusetts help pay for them. And next year San Francisco and Baltimore, risen from their ashes, may help pay for your cities or ours. There is but one way in which we can escape the periodical paying for one another, and that is for us both to begin rational building construction, and then protect what we have builded against fire.

### The Conflagration Problem.

It is the ever-present conflagration hazard which makes any approach to scientific underwriting impossible. The conflagration hazard is not confined to your State, or to any. It is present in every State, every city and town. We have built largely of wood, and sooner or later we must pay the penalty unless we can find some way in which to segregate or protect our cities.

There is one way to solve this conflagration problem—not absolutely, but at least relatively. You cannot be expected to tear down your cities and rebuild them of fire-resistive material; the cities must be protected as they stand. In the heart of nearly every one there are streets crossing at right angles, along which for a very considerable distance are buildings of brick, stone and concrete. Looked at upon the map this shows a more or less complete Maltese cross of buildings which are not wooden, and which operate to divide the wooden-built district into quarter sections, and which might hold a fire in any one of these sections if they were equipped to do so. These brick and stone buildings are ordinarily valueless as fire-stops because their windows are of thin glass and their window frames of wood. At Baltimore and San Francisco the conflagration attacked such buildings easily; breaking out the panes; consuming the frames, and converting every story of these brick structures into horizontal flues full of combustible contents. Brick and stone buildings are logical and capable fire-stops if the fire can be kept out of them. The small city that will trace out its Maltese cross of such buildings, and equip them with metal window frames and wired glass will immediately possess the equivalent of substantial fire walls crossing at right angles in its centre, dividing it into four sections. By such a simple, inexpensive, but yet strategic procedure many a city may save itself from the destruction which now awaits only the right kind of a fire on the right kind of a night.

### Restriction of Fire Range.

I have referred in this plan merely to the smaller cities; but it is obvious that this form of protection is equally imperative in the brick, stone and concrete districts of all large cities where great values are housed in close proximity. Fires in the large cities entail an enormous waste because of the great values assembled there. We must come eventually to the equipment of all commercial, factory and office buildings with metal window frames and wired glass. This will mean the abolition of the conflagration hazard in our cities. Fires will then be unit fires, extinguished easily by a competent fire department

within the building in which they originate, for the protection of window openings not only prevents fire from entering but prevents fires from issuing out of the burning building. We may expect an occasional exceedingly hot fire to break down the defences of an adjoining building, but it is obvious that a conflagration could not get under way among buildings of fire-resistive construction with properly protected window openings.

### Sprinkler Equipment a Necessity.

Having thus fortified city buildings one against the other, extensive fires within individual structures can be prevented by the use of the now well established automatic sprinkler system. The automatic sprinkler applies the water without the help of human agencies while the fire is still incipient. It will operate in a dense smoke as well as in a clear atmosphere. It will not throw excessive deluges of water in wrong places, as the fire departments are continually forced to do. With our window openings protected and our buildings equipped with such extinguishers the conflagration hazard in mercantile districts will be eliminated. There will then remain for consideration our immense residence districts constructed almost wholly of wood surrounding the mercantile centres, like fagots around a funeral pyre. We can lessen the loss here by the abolition of the use of wooden shingles.

### Abolition of Shingle Roofs.

The prohibition of the shingle roof, which is now generally recognized as a conflagration breeder, is to-day almost universal within city fire limits, and from the more enlightened communities it is excluded altogether. Burning shingles can be carried great distances by the wind or draught of a conflagration, and when they alight in their turn upon other dry shingles, they make fearful havoc. The natural anarchy of the American temperament does not readily respond to admonitions to correct its careless habits and recognize its public responsibilities; but our common impoverishment by the stupendous proportions of the fire tax is beginning to impress itself upon us so forcibly that even the most heedless of us is forced to give some thought to the common good and the common safety.

It will not be necessary to remove all shingle roofs immediately. An effective city ordinance might require all roofs constructed in the future to be of incombustible material, and that all roofs which shall hereafter require repair to the extent of one-third of their area shall be replaced with incombustible roofs. The modern shingle is thin, and the machinery which now makes it leaves a fuzzy surface which, after a period of draught, becomes like tinder. Without shingle roofs, flying brands would not be carried over the brick centres of the city by the wind.

### People's Habits Require Correction.

Outside of the abolition of the shingle roof, we must look for the protection of our homes to the corrected habits of our people. We must look carefully after the heating apparatus of our homes, giving them the constant and necessary attention demanded by receptacles containing fire. The building of proper flues and chimneys is especially necessary in connection with residences. The most vital matter in the home, however, is the proper use of the match. Every match is a potential conflagration, as every fire is of the same size when it starts. No match should be admitted inside a house except the variety which ignites only on the box. Hundreds of women and children are burned to death in America every year by the type of match that will ignite on any surface. These matches are allowed to lie indiscriminately about the homes. Small children are imitative, and if they can secure such a match, will attempt to ignite it, generally setting fire to their clothing. No father who has proper regard for his family will allow a "strike anywhere" match in his home. The observation of the precaution I have indicated would mean an almost immediate reduction of the fire waste by perhaps fifty per cent.

**PHILOSOPHY OF LEARNING A TRADE.**

**To make a good living; to have a happy family; to make preparation for hard times; to wear overalls in the shop with the same dignity as good clothes are worn on Sunday; to be confident you are laying a sure foundation for any future success; to feel that you are master of your work and that you share the creative spirit; this is the wholesome philosophy of learning a trade.—Milton P. Higgins in "Grits and Grinds."**

### Fire-Fighting Agencies.

There are other matters, however, to which we must now give proper thought. Among them is the best use of the fire-fighting agencies which have been established, and which are maintained at a great cost by our people.

The mental habits of a people are a vital factor in affecting social progress. It is the mental habit to assume that fire departments are maintained for the exclusive purpose of extinguishing fires. It is obvious, however, that fire departments have large possibilities for service in preventing fires; a service which is, I regret to say, yet largely potential. Every fireman, from the chief engineer down to the drivers and pipe men, should be regularly detailed for inspection service. Three or four hours a week should be spent by each man, going into basements, attics, courts and alleys, keeping down accumulations of rubbish—which spring up over night and locating the storage of inflammable oils and explosives. This would keep the city clear of its most persistent fire dangers. Every fireman should in turn cover every section in the course of six months. One would thus check up the inspections of the other, and local conditions would become a matter for educative conversation about headquarters.

### Education of Fire-Fighters.

There is, however, a most important result to be achieved by such an inspection system over and beyond keeping the city clean; that is the education of the fire-fighters in the exact physical character of the city. To know exactly which passageways are open and which are closed; to know which are fire walls and which are not; to have a mental picture of the exposures, the windows, the roof openings, the cornices, and all the other physical details important in fire-fighting, would so heighten the team work of a department that, like expert swordsmen, they could make their thrusts without loss of time, straight at the vulnerable part. There are a few cities in America where this practice, partially in effect, has already demonstrated its singular efficiency. The citizens of every town and city in the country should demand a like service from its fire department.

### Public Awakening to the Issue.

The American people are not dull in comprehension nor, are they slow to act, once the necessities of a situation are made clear to them. The awakening of the present year, manifested by the observance of "Fire Prevention Day" in many States; by the appointment of fire marshals and the amendment of the fire marshal laws; and by the teaching of the fire hazard in many public schools, indicates that we as a people will not much longer tolerate our pitiful impoverishment by the fire waste. It is true that so long as our wooden cities stand they must occasionally suffer disastrous fires with, oftentimes, shocking loss of life; but with the growing disposition to hold our citizens personally responsible for their carelessness before the bar of public opinion, many of our most prolific causes of fire will disappear.

Our civilization grows daily more complex. Every man's life is becoming

more inextricably linked with the lives of others, hence, an injury to one is increasingly an injury to all. Out of a proper realization of these facts is coming a larger sense of civic responsibility. As citizens of a common country and brothers of a great national family we may some day evolve a civilization in which there shall be no waste, and in which the thought of the common good shall be the profoundest impulse in the hearts of our people.

## THE SHARING OF KNOWLEDGE AMONG ENGINEERS.

By Chas. T. Main, Boston.

AN engineer possessing information not of a private nature and of benefit to the profession in general, should be broad enough in his outlook to publish same for the benefit of his brother craftsmen. He will find on looking at the matter even from a selfish point of view, that he will not be the loser, for it will bring him into greater prominence and call attention to the fact that he is the man to be employed or consulted in work involving this particular experience.

Such men should always be glad to impart to the younger generation any information available. They should never stand in the way of a younger man improving his position, even if it is at a sacrifice to their own interests. If the younger man has an opportunity of obtaining a better position elsewhere, it should either be met with equal consideration of some sort or he should be allowed to make the change.

Younger men, on the other hand, should be governed by a feeling of loyalty to their employers and profession. This should deter them from taking undue advantage of circumstances, which for the time being, might temporarily enhance the value of their services. The relation of an engineer and his assistants should at all times be governed by a spirit of fair play on both sides.

## CANADA'S SUPPLY OF COAL.

CENTRAL Canada is constantly within measurable distance of a coal famine; nor are the conditions which may precipitate such a famine in any considerable degree within the country's control. This is due to the fact that all Eastern and Central Canada is dependent on the Pennsylvania fields for their supplies of anthracite coal. In view of threatened strikes of the Pennsylvania miners, the situation becomes of unusually grave importance to Canadians. It is only when such strikes occur that the public actually realizes how dependent it is upon supplies of United States coal. Again, very few seem to realize the fact that the supplies of United States coal, both anthracite and bituminous, may be entirely denied us at any time. Mr. George Otis Smith of the U.S. Geological Survey, says: "Let us keep our coal at home, and with it manufacture whatever the world needs." Should this happen, can we say that we are prepared to get along without it?

### Dependence on United States for Anthracite.

According to a recent estimate, anthracite coal in the United States will be exhausted in less than two hundred years. Long before that time the cost will increase and the United States Government will see to it that the coal is not exported, but kept at home for its own needs. Let us see to what extent United States coal is sold in Canada. Enquiries sent out by the Commission of Conservation show that the following Provinces are supplied with anthracite coal from the United States:

| Province-Cost to Consumer. | |
|---|---|
| Nova Scotia | $6.50 to $7.00 |
| Cape Breton | 6.50 to 8.00 |
| Prince Edw. Island | 6.00 to 6.50 |
| New Brunswick | 7.00 to 8.00 |
| Quebec | 6.50 to 7.50 |
| Ontario (East of Port Arthur) | 6.00 to 7.75 |
| Ontario (West of Port Arthur) | 8.00 to 11.00 |
| Manitoba | 11.00 to 12.50 |
| Saskatchewan | 12.50 to 15.00 |

### Our Bituminous Coal Supply.

With regard to bituminous coal, Ontario, west of Cornwall, is supplied entirely from the United States. Owing to the low freight rate, Nova Scotia cannot compete with United States coal west of Cornwall. The bituminous coal consumed in Manitoba is almost entirely from the United States, although coal mined in the Crow's Nest and Lethbridge districts finds a ready market in Western Manitoba.

From the above, it can be seen that one of the most important questions we have in Canada, at least in the Province of Ontario and the Prairie Provinces, is the question of fuel. The fuel for the Prairies Provinces will necessarily be supplied in the form of coal and briquettes from mines in British Columbia, Alberta and Saskatchewan. This, however, does not apply to the Province of Ontario, and for economic reasons stated before, Nova Scotia coal cannot find a market in Ontario.

### Peat as a Substitute.

The other sources of heat, light and power are peat, wood and hydro-electric power. Of these, peat and hydro-electric power only can be considered as substitutes for coal. With regard to peat, the Mines Branch of the Department of Mines has demonstrated the fact that peat can be successfully and economically used for fuel and power purposes. Estimating the cost per ton of peat at the bog, $2.00, and the cost of soft coal $4.00 per ton; then in car lots f.o.b., the fuel cost per brake horse-power year (3,000 hours) would be as follows:

| | |
|---|---|
| Peat producer gas plant* | $ 7.50 |
| Coal producer gas plant | 9.00 |
| Steam plant | 36.00 |

Mr. B. F. Haanel of the Mines Branch, in commenting on the foregoing, states that when peat is manufactured on a large scale with machines provided with mechanical excavators and other labor-saving devices, the cost per ton of peat at the bog will be considerably less than $2.00.

While power generated from peat may be successfully used in certain localities in different parts of the country, owing to the low cost of hydro-electric power and the abundance of water-power, the chief substitute for coal which will make Ontario almost entirely independent of United States coal, will be hydro-electric energy. The Hydro-Electric Power Commission has done much to further the use of hydro-electric power by distributing to different centres, and vigilance must be exercised to see that the sources of this energy are not disposed of in such a manner as to deprive the people of power at reasonable rates.

## ROPE CAPACITY OF A DRUM.

THE rule used by the A. Leschen & Sons Rope Co. for computing the rope capacity of any sized drum is as follows:—Add the depth of flange in inches to the diameter of the drum, and multiply this result by the width (out to out) of the drum. This product is then multiplied by the figure below corresponding to the size of rope used:—

| | | | |
|---|---|---|---|
| 1/4 in. | 4.16 | 1 3/8 in. | .138 |
| 3/8 in. | 1.86 | 1 1/2 in. | .116 |
| 7-16 in. | 1.37 | 1 5/8 in. | .099 |
| 1/2 in. | 1.05 | 1 3/4 in. | .085 |
| 9-16 in. | .828 | 1 7/8 in. | .074 |
| 5/8 in. | .672 | 2 in. | .066 |
| 3/4 in. | .465 | 2 1/8 in. | .058 |
| 7/8 in. | .342 | 2 1/4 in. | .052 |
| 1 in. | .262 | 2 3/8 in. | .046 |
| 1 1/8 in. | .207 | 2 1/2 in. | .042 |
| 1 1/4 in. | .167 | | |

**Mr. E. F. Bradley** has been appointed sales manager to the Canada Wire & Cable Co., Ltd. Mr. Bradley has been identified for some time with the Canadian General Electric Company.

# The Modern Boiler Shop and Its Layout and Equipment*

By H. C. Meinholtz

*The author of this paper deals in an easily intelligible, yet comprehensive, fashion with what might be termed the "sound first principles" to be observed by those who would have a boiler and tank building plant designed and arranged to produce quality and quantity work at minimum cost.*

THE planning of a boiler shop involves careful study, principally on account of the variety of work that is, or may be done in a shop fitted with modern appliances. We cannot calculate on building one particular class of boilers, smoke stacks, etc., but must consider also the general line of tank work, smoke flues, flumes and even structural work that must, of necessity, be done in addition to the regular line of boiler work. If a manufacturer has a particular line of work in mind, his principal object is to fit himself with a shop and tools to fabricate such specialty at a minimum cost.

### Choice of Site.

The selection of a proper site for the erection of a shop is very important, and as every boiler manufacturer is expected to attend to repair work besides the building of new work, the site available often determines the arrangement of building and machinery. In order to take advantage of sundry repair work, it is necessary to locate near the manufacturing centers of the large cities. On the other hand, a strictly manufacturing plant may be located on the outskirts or in the suburbs of thickly-populated centers.

Experience teaches us that the better and more intelligent class of mechanics favor living in or close to the large cities, principally because they are offered more opportunities to learn what work is accomplished by other men engaged in the same occupation, and they can also provide better and cheaper means of educating and entertaining their families. While it is true that in a community with an established manufacturing plant, there should be no scarcity of labor, yet we must admit that at certain times a boiler manufacturer is seriously handicapped by a scarcity of work to keep all his men employed advantageously, and at such times a manufacturer located close to the labor market has a decided advantage.

### Constructional Detail of Building.

A modern boiler shop should be of fire proof construction. All woodwork should be avoided as far as possible. The walls, columns, girders and roof should be built of non-combustible materials, and a maximum of natural light and ventilation should be supplied to the workmen. The most serviceable shops have brick or concrete walls with a concrete roof supported on steel trusses. The roof should be reinforced with heavy steel wire and covered with composition or prepared roofing material Ventilators should be provided to carry off the smoke and fumes from the open fires, for hoods such as are usually placed over the fires and heating forges do not as a rule provide sufficient means for carrying off the products of combustion. Window frames, three-sash high, are desirable, as two-thirds of the window opening is thereby available for ventilation. All buildings should be built of ample height and at no point should the distance from the bottom of the roof trusses to the floor level be less than 20 feet.

### Floor and Machinery Layout.

When possible, the shop should have a main erecting floor of suitable width and length, and the craneway should extend the entire length of the shop. The crane rails should be of sufficient height to permit of transferring work from one part of the shop to another without disturbing the work on the floor.

A lean-to should be built on both sides of the erecting floor, and the machinery should be placed in these to preserve a clear and unobstructed erecting floor. Each lean-to, if 40 feet wide, will be of ample size for the punches, shears, rolls, etc. When planning the location of the various machines, the loading and unloading facilities must be considered, since the tonnage of steel passing through a boiler shop is enormous. It is essential that the unloading of raw materials from cars be done at a different point than the loading of the finished product, for in this manner only can a regular route of travel for the work through the shop be established.

Proper racks should be provided so that immediately upon unloading plates from the cars, they can be properly assorted. Racks in which plates are placed in a vertical position are preferable, as less floor space is occupied than when the plates are stored flat. The layer-out should be stationed close to the plate racks and the splitting shears should be close at hand for cutting plates. All the punches should be placed in line, and following these, should be located the bevel shears for planers for beveling the edges of the sheets. Next to these, the rolls should be installed. At this stage of manufacture, the fitting-up is done, and space should be provided for machines to ream rivet holes and to prepare the plates for the riveter. In a 40-foot bay or lean-to, the splitting shears, bevel shears and planers may be set opposite the punches.

The trusses supporting the roof over the lean-to should be of ample strength to support a runaway for small, hand-operated cranes. In a 40-foot bay, parallel runaways, 20 feet wide, should be provided, and so arranged that one set of cranes will pass the other. The advantage of such an arrangement is apparent, as each machine may have its own crane, the operator on any one machine may remove his work and transport it to another machine without interfering with his neighbor. These cranes also can be provided with interlocking devices so that a continuous crane, 40 feet long, can be made of the two shorter travelers.

Owing to the fact that the sharp edges on plates are liable to injure the workmen, it is advisable to have a clear floor all around the machines. Riveters should be placed in the lean-to commanded by the cranes and they should be so located that the work from the riveter can be reached by the main crane serving the erecting floor.

### Machine Drives.

All punches, shears, rolls, etc., should be operated by individual motors of like type and speed. By selecting a few sizes of one type of motor, and by carrying an extra motor of each size on hand, no serious delays can occur, since a spare motor can readily be used to replace a defective machine and no fitting of base plates or change of gearing is required. When no extra motors are at hand, often a motor from another machine not in use may be utilized.

### Flanging Department.

Flange shops should be separated from the main shop, wherever possible, but should be located so that the work may be passed from one shop to the other at a minimum of expense. In addition to the customary flanging machines, a large furnace should be provided so that all flanger work may be heated, straightened and annealed.

*From a paper read at the Boiler Manufacturers' Association Convention, New Orleans, 1912.

### The Power Plant.

The power-house should be isolated from the main and flange shops. In addition to the engine and air compressor, the hydraulic pump and accumulator should be placed in the engine room, so that all power units may be directly in care of the engine room attendant. The hydraulic riveters, punches, flanging machines, etc., should be arranged in such a manner that the distance of travel of the water through the pipes supplying the various machines is reduced to a minimum. Proper shock absorbing valves should be provided as well as safety appliances to prevent over-pumping the accumulator, and a special check valve should be placed in the supply pipe to the accumulator so that in case of a failure in the hydraulic pipe, the accumulator will not drop suddenly and injure the machine or buildings.

The hydraulic pump should be fitted with a speed controlling device so that a fixed speed of the pump cannot be exceeded in case of a break in the pressure line. It has been the custom to equip shops containing machines that are of necessity operated at variable speeds, with direct current generator and motors, but for operating a boiler shop we can safely consider alternating current machines since the variations of speed that may be obtained with alternating current motors are quite ample for all purposes.

### Test Department.

A special section of the shop, preferably close to the loading or shipping track, should be set aside for a test floor, and a system of drains should connect the floor with a reserve or storage cistern.

### General.

While we are considering a strictly fireproof shop, we must, nevertheless, provide the necessary means to successfully fight a fire. An adequate number of non-freezable fire plugs should therefore be installed with the necessary hose and nozzles.

A separate building should be provided for the storage of oils, paints, etc., and only small quantities of these, required for immediate use, should be permitted in the shop.

In the majority of plants no provision is made for heating in cold weather. It is a mistaken idea to expect men to keep themselves warm by work, as a great many of them are employed on jobs that do not require a sufficient amount of energy to enable them to do so. Means, therefore, should be provided to maintain a shop temperature of about 50 degrees Fahr. in severe weather.

## EFFECTIVE STRESS IN BELTS.

IN a recent issue of Zeits, des Vereines Deutscher Ingenieure appears an account of tests on the limits of effective stress in belts of various materials. An abstract of the article appears in the April Journal of the American Society of Mechanical Engineers. Such tests require a large expenditure of time, because overloading of a belt can be discovered only from the appearance of a permanent elongation, and an identical elongation is also found in a new belt which has not yet reached its state of resistance. Since, however, several hours are required for a belt to reach that state, there is always a danger, in short tests with new belts, of taking phenomena of the state of resistance for those of overload.

### Tests of Link Belts.

The tests were made on two link belts of equal width, but unequal thickness, made up of links pressed out of specially prepared fibre, and provided with leather rims. The tests show that at a speed of say 50 feet per second, the total stress on the tight side of the belt must not exceed 166 lbs. per inch, but at higher speeds may go as high as 193 lbs. per inch of width of belt. Link belts have been introduced because they combined the strength of double with the flexibility of single belts, and gave strong belts which could be used on pulleys of small diameter. These tests have shown that for speeds up to 65 feet per second, link belts are far superior not only to single, but even to double leather belts; but at higher speeds, the centrifugal tension in the heavy link belt decreases the allowable useful load very materially, and at speeds over 98 ft. per second, link belts cannot be economically used at all.

### Tests of Leather Belts.

For speeds up to 50 feet per second, the total stress on the tight side of the belt did not exceed say 126 lb. per inch of the width of the belt, while for a speed of 98 feet per second, the total useful tension rose to 143 lbs. per inch of width of belt.

It is often asserted that belts which have the hair side to the pulley, last longer than when turned with the flesh side to the pulley. Tests made by the author show that in belts turned with the hair side to the pulley: (a) the tension ratio or ratio between the tension on the tight side and that on the loose side hardly exceeds 2, while in belts running with the flesh side to the pulley, it can exceed 3; (b) the highest allowable tension is more than 12.6 lbs. per inch less than in the case of belts with the flesh side toward the pulley. Again, the speed cannot be made more than 98 feet per second, against 164 feet with belts having the flesh side next the pulley.

This shows that it is in every respect disadvantageous to let the belt run with the hair side toward the pulley. A belt running in that way probably wears out sooner, because, as was pointed out by C. O. Gehrkens, such curvature reverses the way in which the hide grew on the animal.

### Tests of High Speed Belting.

A double cemented leather belt, 1.8 inches wide, stood very well a total tension on the tight side of 370 lbs. per inch at 196 feet per second, and broke only when the tension rose to say 530 lbs. per inch. The allowable useful stress (kn) can be deduced from the formula:—

$$kn = (kT - kf) \times \tfrac{3}{4},$$

where kT is the total stress on the tight side, and kf the centrifugal tension.

In the tests with woven belts it was found, that, as the speed of the belt transmission increased, the allowable useful stress diminished owing to the influence of the belt fastening, which at speeds from 81 to 98 feet per second caused such vibration and uncertainty of run that it proved to be impossible to exceed the speed of 98 feet per second. The influence of the fastening is due to the following causes: (a) Because the centre of gravity of the fastening describes on the pulley a semicircle, an additional centrifugal tension is developed equal to

$$kf = \frac{G}{bl} \cdot \frac{v^2}{g}$$

This additional centrifugal tension is thus a function of

$$\frac{G}{bl},$$

or weight of unit area of the fastening, and that indicates the advisability of arranging the fastening in such a way that its weight be distributed over as large an area of the belt as possible; (b) The rotation of the fastening in coming on and off the pulley produces in it a moment of torsion which in its turn produces in the belt an additional centrifugal tension. This tension becomes negligible if the fastening is made of flexible steel bands; soft steel bands lasting longer than hard ones.

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In casting brass in sand if the gate breaks off in the mold, it usually indicates that the metal is not good. Such a breakage shows that the metal is red short and breaks while cooling. The difficulty may be caused by the presence of sulphur, antimony, arsenic or other foreign elements in the metal. Bronze or composite acts in the same manner as brass.

# Prominent Features of Forge Practice in English Shops, III.

By Joseph Horner

*The writer is well and favorably known through his contributions to the editorial columns of the leading technical journals of Great Britain and the United States. Concerning Canada, he is no stranger, having on previous occasions furnished highly instructive information to readers of Canadian Machinery on important developments in mechanical engineering practice. The subject of the present series of articles will be found extremely interesting, enabling, as it does, a close comparison between British and Canadian methods to be made, and perhaps profitable hints extracted.*

THE third large group of forged work comprises that which is made in plate or from wide bars by bending, flanging, setting, welding. This includes very massive articles. In England the hydraulic press is employed chiefly for this class of work. There are several designs, varied to deal with different classes of operation, or of operations done in succession to avoid moving the work about, in order to finish two or three operations at one heat. The differences are those of ram arrangements; one, two, or three rams being fitted. The simplest press has one vertical ram moving downwards. Many presses have two; one descending from above, the other ascending from below. A goodly number have, in addition, a third ram moving horizontally outwards from the frame. The utilities of this last type are very great, enabling many intricate forgings to be done at one heat which if attempted on the simpler presses would require two heats.

The powers of useful presses for this class of work range from 50 to 200 tons, and the lengths of stroke from 9 to 30

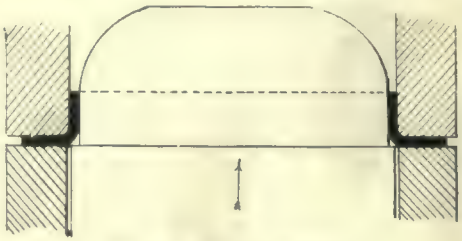
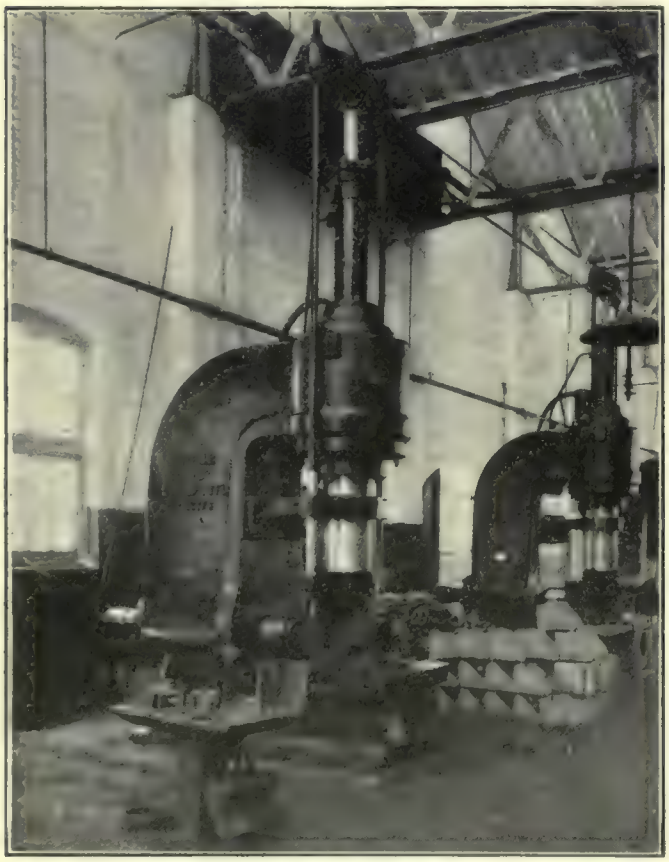


Fig. 23.—Forge Practice.

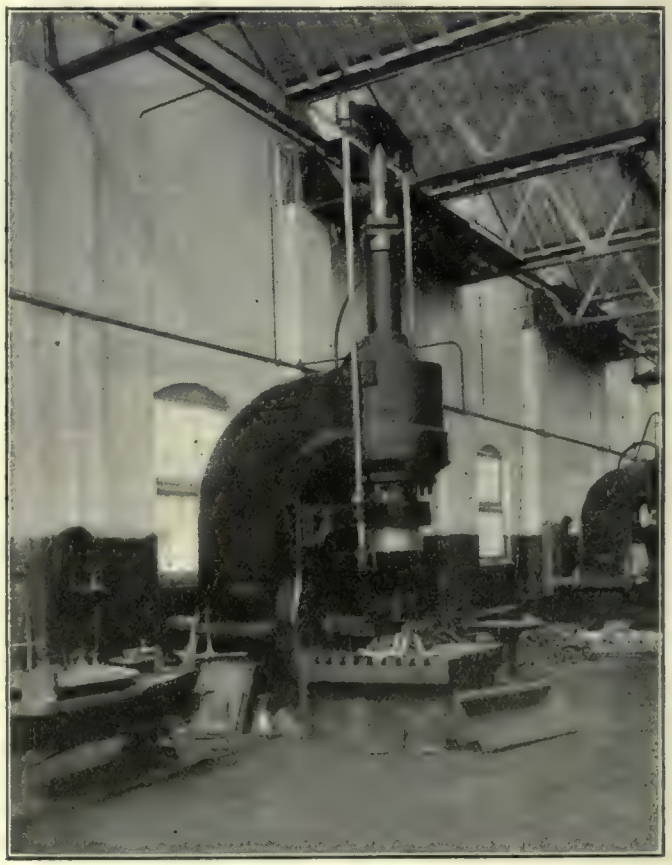
inches. The water pressure is 1,500 lbs. per square inch. Two kinds of machine are built, the older being slower and less economical than the newer, and having the pressure water throughout the entire stroke. In the newer types, water from a tank acting by gravity moves the ram rapidly into contact with the work, after which the accumulator water is brought into action to impart the pressure. An intensifier is also included for the more powerful presses.

### Pressed Plate Work.

Work which is pressed in plates involves an entirely different set of conditions from that which is forged by hammer blows. There is little reduction, often none at all in thickness of widths, but a good deal of bending, and some welding and final setting. The dies are massive; being built of cast-iron and steel. Shapes are stamped out by steel dies screwed to bodies of cast iron. The kind of work for which these presses are properly adapted is of the same class for which the bulldozer is used. They bend,



Forging Press in Swindon Shop.



Forging Press in Swindon Shop.

flange, punch and weld in dies, but are not so suitable for heavy bar work as are the steam and power hammers. Hydraulic presses are, however, nearly ubiquitous in the railway wagon shops for preparing the iron and steel work of wagons and carriages.

Work of this kind when done by the ordinary methods of the forge, entails welding and riveting, or setting and bending blocks, and is performed by the platers and not by the smiths. By comparison with these methods, the time saved is enormous. In some cases, these forgings take the place of castings with much reduction in weight and freedom from risk of fracture. Many examples might be given, but they would entail numerous drawings. The photographs show forging presses and dies taken at the Swindon Works of the Great Western Railway, and will give a good idea of the nature of the work done. The work regularly done includes rings, spring shoes, brake parts, spring buckles, shoes of various kinds, draw bar plates, covers, buffer sockets, axle guards, etc.

Hydraulic Presses at Swindon, with Samples of Work Lying Around. Presses by Fielding & Platt, Gloucester.

Forging Presses in Swindon Shop, With Buffer Sockets Adjacent.

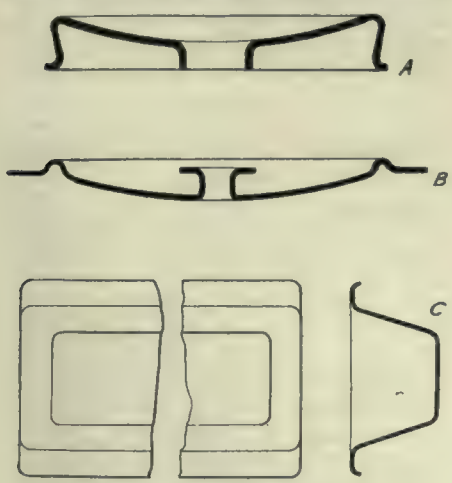



Fig. 24.—Forge Practice.

### Possibilities of Pressing.

The possibilities of pressing may be inferred from a few selected illustrations of the work. The drawing, Fig. 22, is a rather common example of simple work. It shows how a manhole is pressed in ordinary practice; idential methods being adopted for the rings for uptakes of vertical boilers, in hand holes, tank openings, and similar articles. The plate cut to the right diameter on rotary shears, in the lathe, or punched out in small diameters, is laid on a die and pressed into the opening of the latter with the punch attached to the top either of the press or of the hammer. One movement suffices to complete the job. Fig. 23 illustrates another method practised under the hydraulic press. The upper and lower portions of the dies secure the flange while the lower die moving upwards turns the plate to shape within the upper die.

Fig. 24 is a group of forgings all made in dies in hydraulic presses. The plates are heated in reverberatory furnaces and pressed in massive cast-iron dies. (A) is a piston, (B) a cover for brake cylinders, each done in several stages, and (C) a trough or manger about 5 feet in length, stamped in one piece of plate. The article (A) is stamped first with the outer flange plain. The setting is done afterwards in stages by the horizontal ram of the press actuating a die-block of suitable shape. In the forging (B) the flange and neck are both prepared separately and welded to the plate The welding is done between divided dies before the plate is pressed to its dished form; this being done at one squeeze, between top and bottom dies; the top die having a recess in the centre large enough for the flange and neck to pass up into.

## ROPE DRIVING.

IN a paper read by Mr. R. E. Hart before the Association of Engineers-in-Charge (England), the author defined the requirements for a successful rope-drive.

The main features of an ideal rope-drive are that the diameter of the pulleys shall not be less than thirty times the diameter of the rope used, and the driving and driven pulleys shall, if possible, be of equal diameter; but where this cannot be arranged, their ratios

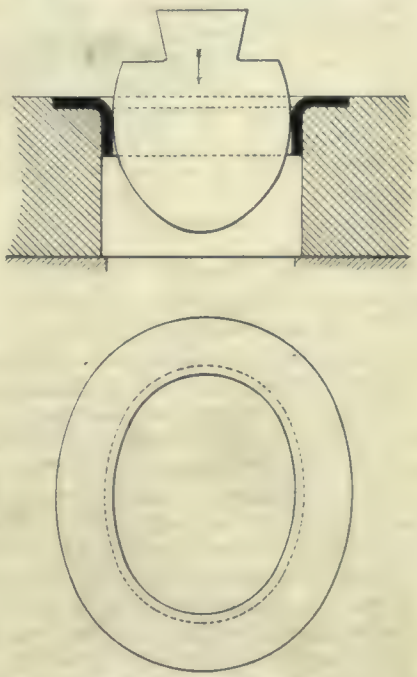


Fig. 22.—Forge Practice.

should not be greater than 5 to 1. The distance between the pulley faces should, if possible, be not less than 25 feet, and the drive should be horizontal, with the slack side of the rope on the top. The

speed may be from 2,000 feet to 4,000 feet per minute, but if too low the ropes are apt to slip, and if too high, the action of centrifugal forces affects the efficiency.

There should be a distance of from 4 to 6 feet clearance under the ropes, and these must, of course, not rub on anything. An allowance of 2 or 3 inches clearance between the bearing foundations and the sides of the pulleys must be made so as to leave room for the ropes to be put on to the pulley. The pulleys must also be accurately in line, well balanced, and the grooves exactly alike.

All gears between the prime mover and the rope-drive should, if possible, be avoided; the ropes should be kept dry, properly lubricated, and not too tight. They should all be put on at one time, and the full load applied to them as soon as possible after they are in place. Carrier pulleys, rollers, and angular drives should be avoided as much as possible.

### Type of Rope.

Regarding the two types of rope generally used—namely, three-strand and four-strand—the former can be made more pliable than the latter, and it is also stronger; but these advantages are more than counterbalanced in the four-strand rope, because, compared with the three-strand, it stretches very much less, and has a larger surface in contact with the pulley grooves. It is also capable of a stronger splice. A well-made four-strand rope is, moreover, nearly as strong as a three-strand, but it requires more skill to splice it. The general opinion, now, is that cotton is the best material to use for driving-ropes, and Egyptian cotton, though a little more expensive than American, is generally preferred.

## THE PUBLIC'S DEBT TO LABOR.

WHEN we review the field of human endeavor, we find that many of our national glories have been produced at an unnecessary sacrifice of human labor. To the laborer and the mechanic belongs the honor for producing the vehicles in which we ride, the clothes we wear, the buildings in which we live and work, and the machinery that plays an important part in everyday life. Still the lives of these men are considered of little value in the mad rush to excel in commercial competition. In the race of the industrial juggernaut, human lives are maimed and crushed, figures stunted and deformed, bodies poisoned, women made widows and children orphans.

Capital has become indifferent to the interests of labor in many cases, but thanks to measures instituted by organizations that have the welfare of the laboring classes at heart, remedies to eradicate many evils have been brought into action of late and it is to be hoped that such work may continue until a standard that insures the fullest protection possible has been reached.

More efficient guarding of machinery in factories is required, and in this connection, an increased demand for more factory inspectors and a more efficient organization of the factory inspection force is desired. There is great need for better ventilation in our factories and steps are being taken in the introduction of measures that will make better ventilation compulsory in buildings where workmen are congregated.—Nat. Coml.

## CONCENTRATION OF ENERGY.

A SAVING of about 200 million tons of coal annually is estimated by Mr. Samuel Insull as the result of a general concentration of energy production in the United States. When addressing the American Institute of Electrical Engineers, Mr. Insull made further calculations which ought to encourage and inspire the growing number of engineers who are bestirring themselves to awaken public opinion on the question of fuel economy. In New York, the total load on several systems of generation is 678,000 k.w. If they were consolidated, the diversity factor would come into operation to reduce this amount by 47,000 k.w. In Boston, Mr. Insull estimates that if the lighting and traction loads were dealt with under one system the maximum demand would come down from 111,200 k.w. to 95,400 k.w. Further great economy would, of course, result if the steam railway services were brought into the scheme.

The ensuing discussion was enlightened by contributions from some of America's foremost authorities, and one of the most remarkable was that of Professor Dugald Jackson, who declared that such concentration of energy would be necessary to maintain the cities of the future as suitable places for habitation.

## STEEL PRODUCTION IN THE UNITED STATES.

ACCORDING to statistics received from manufacturers by the American Iron and Steel Association, the production of all kinds of steel ingots and castings in the United States during 1911 amounted to 23,675,501 tons, as compared with 26,094,919 tons in 1910; this latter being the largest total recorded in that country for one year. The total of 23,955,021 tons in 1909 was the nearest approach to 1910. The 1911 production was made up of 23,029,479 tons of ignots and 646,022 tons of castings; it included 7,947,849 tons of Bessemer, 15,598,650 tons open hearth, and 129,002 tons of crucible and other steel. It is noteworthy that the production by the electric process amounted to 29,105 tons, as against 52,141 tons in 1910. In 1911 there were nine electric plants in operation; one in Massachussets, three in New York, three in Pennsylvania, one in Indiana, and one in Illinois.

## SWEEP MOULDING AN OIL TANK IN GREEN SAND.

By J. H. Eastham.

THE article entitled "Sweep Moulding an Oil Tank in Green Sand," which appeared in our May issue, was incomplete, to the extent that Fig. 6, showing the finished mould was omitted. It is here shown, and in conjunction with it, the last paragraph of the article has been reproduced as follows:

The cross section view of the finished

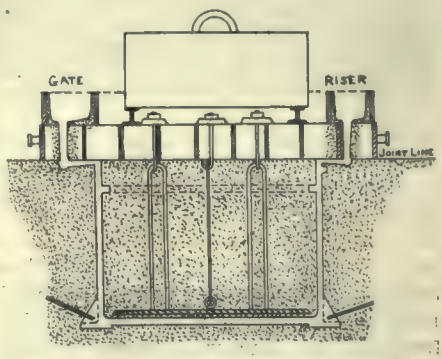



Fig. 6—Sweep Moulding an Oil Tank in Green Sand.

mould, at Fig. 6, shows type of runner and riser adopted, hook bolt and lifter arrangement, straight irons over and under the flange, and seating brackets.

## AMERICAN ELECTRO-CHEMICAL SOCIETY.

Mr. William Lash Miller, professor of chemistry at the University of Toronto, has been elected president of the American Electro-Chemical Society. To a Canadian this is a signal honor, in view of the fact that he will represent the American Electro-chemical Society at the Congress of Applied Chemistry, which meets in Washington next September, on the invitation of the President and Government of the United States.

At this meeting, which is held every five years, there will be industrial chemists from all over the world. This will be the first time the society has met in America, the last meeting having been held in Rome.

# U.S. Committee Report on Systems of Shop Management

*The United States House of Representatives in the early fall of 1911 appointed a committee to investigate the various systems of "shop management," which had been propounded and introduced into the practice of a number of private manufacturing concerns and to a limited extent into several Government works. The thoroughness of the investigation and the reasonableness of the conclusions arrived at, will, we are sure, be generally approved.*

### SCOPE OF THE INQUIRY.

YOUR committee appointed under House resolution 90, adopted August 21, 1911, respectfully submits the following report:

By the provisions of the resolution under which it was appointed, your committee was directed "to investigate the Taylor and other systems of shop management, which investigation shall include its applicability to Government works, its effect on the health and pay of employes, its effect on wages and labor cost, and such other matters connected therewith as may give a thorough understanding of the results of the installation of this system."

#### General Observations.

We have examined a number of witnesses relative to the various systems of shop management which have been worked out and are being introduced in a limited number of establishments throughout the country, but we have given special attention to an investigation of the Taylor system, because we found that this system is being introduced in part in two Government arsenals and its extension into other Government plants is being seriously considered by the officers of the ordnance bureau of the War Department. All of these systems, including the Taylor system, have become known by the general term "scientific management" and are referred to as such throughout the hearings, a copy of which accompanies this report.

A great amount of good work has been done by Mr. Taylor and others in working out the details of scientific methods of shop management, but neither Mr. Taylor nor anyone else has presented to this committee a system so complete and perfect as to justify a recommendation that it be imposed in any Government shop.

#### Gradual Evolution Desirable.

Any radical change in factory management should be a gradual evolution out of that which has preceded. The present systems, or lack of systems, with their good and bad points, are themselves the result of long evolutions. No drastic or radical change in them should be suddenly or even quickly imposed by fiat from above. Men have become accustomed alike to the good and bad that are in the systems under which they work. They know and approve the good; they know how to combat the evil. They are naturally and properly suspicious that motives purely selfish may be behind the sudden change. Confidence is a plant of slow growth.

Neither the Taylor system nor any other should be imposed from above on an unwilling working force. Any system of shop management ought to be the result of mutual conference and mutual consent, and that takes time. Government in a mill should be like government in a state—"with the consent of the governed."

It appears to your committee that no one can seriously object, and as a matter of fact, no one has objected, to any system which so standardizes and systematizes the work to be performed that a greater amount of production is secured with the same expenditure of labor. Employer and employe alike and the public generally are interested in securing the largest amount and the best quality of production that can possibly be secured by the amount of labor expended. All men have a mutual interest in the accomplishment of that end. It is only when it comes to a division of that which has been produced that their interests diverge. It, therefore, follows that any system of management, which has a tendency to destroy the power of employes, individually or collectively, to secure the equivalent of the production which properly belongs to them, must be looked upon as being dangerous to the welfare of the community at large.

Efficiency must not be had at the cost of the men, women and children who labor and who should be the primary beneficiaries from it. We should study how to produce the best results in output while also producing conditions to make the most efficient men and women to produce that output. This must be done by conserving in every way not only their health, physical and nervous vigor, but by creating such conditions as will permit them to work out their own happiness and contentment through wages which will enable them to live in such a manner as to maintain their own self-respect, and with sufficient leisure to enjoy the refreshing influence of mental and moral recreation.

#### The Taylor System.

The Taylor system of shop management may be divided into three general heads: Standardization, systematization, and stimulation. Efficiency may be gained in whole or in part by any of these ways; by any two of them, or by all three combined. Any or all, however, may be carried to an extreme.

In the first two, standardization and systematization, the expense which would be created by carrying them to an extreme would act as a check against the continuance of such a condition, but that check would not exist in that portion of stimulation which is applied to the workman. The expenses of standardization and systematization are borne by the management, while the expense of stimulation in the form of increased energy is borne by the workman. Any system of shop change through standardization or systematization which is too heavy for the shop to bear or which imposes burden charges through stimulation which are too heavy for the workman to bear, should be discontinued.

#### Loafing and Labor Distinctions.

That there is loafing or soldiering among workmen has been shown by the testimony before your committee, but it is not general nor does it occur in numerous instances compared with the total number employed. Ordinary intelligent management under any system could eliminate it entirely, or, at least, reduce it to the point where it would not be a serious hindrance to production. Because there are some loafers is no reason why the remainder of the workmen should either be compelled or induced to work up to the very edge of the breaking strain.

There is need for production at the lowest cost, but no economic necessity can justify workmen being required to speed up to the highest point which they can continue from day to day and from year to year, even without injury to their health and strength. To place workmen in a position of that kind is to put them in the position of a beast of burden, which is required to go on from day to day performing a given task. There is a margin between the work performed by the loafer and the maximum task for a man. In that margin lies a proper day's work. What constitutes a reasonable day's work can only be determined by practical experience and intelligent observation. It can not be wholly determined by a stop watch or any other time-measuring in-

strument used only for a brief period of time.

**Man Not a Machine.**

By the stop watch you may be able to determine the time in which a piece of work can be done, but you do not thereby also determine the length of time in which it ought to be done. The time study of the operations of any machine can be made with a reasonable degree of accuracy, because all of the elements can be taken into consideration in making the computation. A machine is an inanimate thing—it has neither life, brain, sentiment, nor place in the social order. With a workman it is different. He is a living, moving, sentient, social being; he is entitled to all the rights, privileges, opportunities and respectful consideration given to other men. He would be less than a man if he did not resent the introduction of any system which deals with him in the same way as a beast of burden or an inanimate machine.

**Time Study Unreliable.**

In making a time study of the operations of a workman, all of the elements cannot be taken into consideration, and consequently, the computation cannot be made with mathematical accuracy. There is no work that can be performed, or that is performed, that is not preceded by a mental process on the part of the workman. The more skill needed in the work, the greater the mental process which precedes the expression of it.

So far as your committee has been able to learn, there is no method known to scientific management by which a time study can be made of the mental process preceding the physical act. The elements of the mental process not being susceptible of determination by a stop watch time study, the study of itself must consequently be inaccurate and the workmen are justified in objecting to such a time study being used as a basis upon which to compute their day's work and compensation, when in their judgment injustice is thereby done them.

**Stimulation Methods Adopted.**

In an effort to stimulate workmen to increased activity, various methods are used under different systems—such as discharge, fear of discharge, stop watch time studies, and bonuses. The fear of discharge exists under any system, and, no doubt, will continue to exist and to act as stimulus. The establishment of a premium or bonus presupposes the establishment of a task. The bonus system is based upon the establishment of a task large enough for an ordinary day's work and then giving additional compensation as an inducement to a workman to do more than he would ordinarily do.

**Employer and Employe Co-operation.**

The proponents of the Taylor system assert that the workman will be protected against any injustice either in the amount of work required of him or the compensation for that work by a change in the mental attitude brought about by the introduction of the system. A mental attitude which produces a spirit of co-operation between the employer and the employe is much to be desired, but such a spirit is not the result of any particular system of management, but is due almost entirely to the personality of the management and employe and the spirit that prevails in their relations to each other.

Your committee is of the opinion that the mere mental attitude of the employer is too variable and unsubstantial a basis upon which to rest the material welfare of the wage worker. Standardizing and systematizing of work can be introduced successfully without any change in mental attitude from that which exists in the ordinary shop, but when it comes to introducing stimulation, a change of mental attitude by which the workman is willing to give a greater amount of energy for the same amount of pay may be very desirable to the employer of labor, but it is not always so desirable to the employe.

**Standardization Desirable.**

The Taylor system undertakes to standardize the tools, machines, nuts, bolts, etc., so as to eliminate as far as possible the loss of time and waste energy resulting from the lack of standardization. This is "a consummation devoutly to be wished." It was shown to your committee that in the Watertown arsenal, prior to the change in system, there were several kinds of gear cutters run by one man. They were of different makes, capacities and ages, and operated on different principles. It was also shown that the nuts and bolts used were not standardized and consequently much time was lost by the workman in searching for sizes for his machine. This is not good practice.

The machinery should be standardized—made alike in principle, if not in size, so that the time of the workman need not be wasted over different kinds of tools in an effort to find the right one. It is an advantage to have standard hand tools in our shops, as far as possible. Similar operations on similar work can be advantageously done in a similar way. It is a great waste of effort and thought to perform one operation in one way to-day and in another way to-morrow. It is a still greater waste to perform one operation in three or four different ways at the same time.

Where there is no standard, a man never gets a chance to produce the best results, and even when he works hard he makes a comparatively poor showing. Standardizing can, however, be carried too far. When standardization has reached the point that the cost of maintaining it is greater than the saving resulting therefrom it should be discontinued.

Any system that eliminates unnecessary and wasted effort is good. It does not necessarily follow, however, that because any particular system has been branded as scientific that the brand alone makes it such. Conditions vary in different shops and a system which would be effective in one might not be as effective in another. The work and responsibility of selecting, evolving, or introducing a system suitable to a particular shop must in a great measure depend upon the intelligence of the management.

**Management Intelligence.**

The Taylor system undertakes to systematize the work, first, by the establishment of a planning department; second, by detail study of the shop and the elements of a particular piece of work; and third, by a routing system; out of all of which grow a multiude of other details, such as job cards, routing cards, time study, and many others. So much of this kind of detail work is needed under this system that it appears to your committee that constant care would have to be exercised in order to prevent the overhead charges thus created from using up all of the benefits which might be derived from the proper systematization of the work that is under way.

Every well-regulated industrial establishment should have a planning department proportioned to the size and need of the shop. In establishing a planning department, practical common sense should be used the same as in everything else. In a small shop, the manager might easily be his own planning department. In large establishments a separate department could be utilized to advantage for the proper planning of the work. In other words, every shop should be provided with the means of properly planning the handling of all work that comes to it so as to get it through the shop with the least possible waste of energy or loss of time to either men or machines.

A detailed study of the elements of every piece of work for the purpose of discovering the best system of handling it and the elimination of unnecessary work on the part of the workman may be, and no doubt is, under some circumstances, productive of good results. This is particularly true when unskilled men are selected to do skilled work and it becomes necessary to study their movements in order to train them to that

standard of efficiency which skilled men have already attained; but it is neither as essential nor as beneficial where men are employed, who are trained and skilled in the particular line of work they are expected to do.

**Elimination of Unnecessary Motion.**

The elimination of unnecessary motion in doing any work is always a benefit, because it conserves the vitality of the workman and makes his labor more productive. It should, therefore, be the duty of every foreman to observe the efforts of his workmen with a view of correcting any improper methods and removing unnecessary motion in their work. It cannot, however, be expected that every workman who has spent the greater part of his life in doing work by methods which have become familiar to him would in all instances become more efficient by the adoption of some other method, even though the other method eliminated unnecessary motion. In the judgment of your committee, the determination of whether or not a detailed study of the methods of the workmen should be made, would, in a great measure, depend upon the skill or lack of skill of those required to do the work.

**Routing of Work.**

It is always an advantage to have the work properly routed through the shop, although it is not at all time necessary that a routing card should be made out to accompany the work. In small shops the routing might be done very effectively by the oral direction of the foreman. In larger establishments, routing cards are beneficial for the effective handling of the work, and they are made more effective when the machines are properly arranged and grouped, so that the work can pass through with as little handling as possible, but even in large shops where the same work is being duplicated day after day it would be a waste of time and an unnecessary expenditure of energy to furnish a routing card for any job after the work has reached the point where it automatically routs itself. Here is the crux of the difficulty in the introduction of the Taylor or any other system of so-called scientific management. So far as the workmen are concerned, they have not made any serious objections before your committee to standardizing or systematizing of the work, but they have vigorously protested against stimulation on the grounds that it tends to injure their health through overwork, and that while their wages may be temporarily increased, the result is that they are ultimately required to expend the greater amount of energy without receiving any additional pay.

In the judgment of your committee the best and most effective stimulus that can be given to the work in a shop is to secure and hold a fine spirit of cooperation with the management on the part of the workmen. That cannot be secured through timing the operations of the workman with a stop watch when he considers such a procedure an indignity which recognizes him as being in the same class as a beast of burden or a machine, or when he considers such a time study inaccurate, and, therefore, unjust to him, or when he knows that it is to be used as a basis from which to compute the speed at which he must work and the wages he is to receive; when in his judgment the work, speed and wage rate are being established in order to secure greater profits for the employer at the expense of the workmen.

A straight piecework basis may be used as a stimulus to workmen without injury to them, on work that is continuously duplicated for a prolonged period of time, provided the workmen are so situated that they can protect themselves against the entire power of the management being centred upon them individually to compel them to work beyond their normal capacity, and provided, further, that they can secure a satisfactory guaranty that when the piece rate has been once established it will not be reduced unless the methods of production are materially changed, and reduced then only in proportion to the reduction in mental and physical energy required in the production of the article. In any form that stimulation may be used, except that of true cooperation, continuous care must be had that quality is not sacrificed to quantity.

**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**

**Conclusions and Recommendations.**

Neither the Taylor system, the Emerson system, the Gantt system, the Brombacher system, the Stimpson system, nor any of the systems of so-called scientific management have been in existence long enough for your committee to determine with accuracy their effect on the health and pay of employes and their effect on wages and labor cost. The conclusions we have arrived at are all based upon what we consider to be the logical sequence of the conditions existing or proposed. The selection of any system of shop management for the various government works must be to a great extent a matter of administration, and your committee does not deem it advisable nor expedient to make any recommendations for legislation upon the subject at this time.

We recommend: Wherever possible, in Government work, that machines, tools, nuts and bolts should be standardized; the management using continuous care that the cost of standardization shall not exceed the benefits to be derived from the same. The management should at all times give studious attention to the proper systematizing and routing of work, the grouping of machines, the furnishing of proper tools and equipment, and the elimination of waste motion and waste energy on the part of the workmen. Careful study should be made of machines in order to attain the speed and feed which will secure the highest and best possible production.

The management should put forth every effort to invite and induce full cooperation between the working force and themselves, and should, therefore, deal with the working force in the most open, frank and candid way, affording the fullest opportunity for consultation and explanation in advance of proposed action affecting the interests of the workmen.

Stop watch time study should not be made of workmen without their consent or any conditions imposed upon them by authority which imply any indignity. Piecework may be introduced where the work to be performed is a continuous duplication, but with the express understanding that piecework rates shall not be cut unless the conditions of production are materially changed. In other cases, the rate should be a straight daywage rate at the highest prevailing rate for a similar class of work in the neighborhood where the Government work is to be performed, except that by mutual consent, bonus and premium work may be introduced, but only with scrupulous care that the workman shall have full opportunity for increasing his earnings without risk or overstrain, for collective bargaining if he should so desire, and for easy and direct appeal to the management in any cases where he may think his interests threatened.

**Personnel of the Committee.**

The personnel of the committee of investigation was as follows: W. B. Wilson, chairman, Pennsylvania; William C. Redfield, New York; John Q. Tilson, Connecticut. Mr. Redfield is vice-president of the American Blower Co., Detroit, Mich.

## C.N.R. MACHINE TOOL REQUIREMENTS.

THE Canadian Northern Ry. has issued from Winnipeg a list covering its 1912 requirements of machine tools, for which tenders will be considered in the near future. The list is as follows:—One 80-in. drive wheel lathe, complete with 220-volt direct current motor and controller: one 42-in. double head upright boring mill for boring tires; one hollow spindle turret lathe, capable of taking bars up to 6 ins. diameter; one 24-in. upright shaper; one 14-inch upright slotting machine; one hollow spindle turret lathe, capable of taking bars up to 2⅛ ins. diameter; one 18-in. brass turret lathe; one 20-in. brass turret lathe; one 20-in. sensitive drill press; one 36-in. back geared drill press; one 8-in. pipe threading and cutting machine; one 2-in. double head bolt cutter; one 1½ in. triple head bolt cutter; one 48-in. blast fan for supplying air to oil furnace; one motor driven air compressor, capacity 1,000 cu. ft. free air per minute, compressed to 115 lbs.; one Lassiter automatic stay bolt drilling machine; one roller type tube welding machine; one 1-in. 6 spindle, semi-automatic nut tapping machine; one 24-in. planer; one 8-roll patent triple cylinder sandpapering machine; one scroll sawing machine; one 4-spindle Universal boring machine; one Universal dado and saw machine; one rod, dowel and pin machine; one band-saw with 36-in. wheels; one concentric slide wood turning lathe; one 2½-in. double bitted surface planer; one 6-spindle vertical stay bolt threader; one No. 8 Beaudry Champion power hammer; one No. 3 washer cutting machine; one 36-in. Bullard vertical turret lathe; one 24-in. by 36-in. by 14-ft. gas engine lathe; two 24-in. column shapers; two 36-in. back geared upright drill presses. The approximate cost of the whole will be about $35,000.

## MANITOBA BRIDGE & IRONWORKS CO.

NORTH Transcona is to have another big manufacturing plant before the close of the year. It is learned that the Manitoba Bridge and Iron Works Limited, have secured an option on 30 acres in the southwest quarter of 16: 11:4 east, as a site for a million dollar steel plant. The property in question lies east of the new C. P. R. yards at North Transcona and is at the junction of the lines of the Canadian Northern and Grand Trunk Pacific railways. The price named is $1,000 an acre.

T. R. Deacon, president and general manager of the Manitoba Bridge and Iron Works, Ltd., recently returned from Gary, Indiana, where he has been inspecting the plant of the American Bridge Company. He was accompanied on this trip by H. A. McKay, chief engineer of the Winnipeg concern. The plant of the American Bridge Company is said to be the most modern of its kind on the American continent, and the new plant at Transcona will be modelled upon similar lines to that now in operation at Gary. Engineers of the Manitoba Bridge and Iron Works are preparing plans and it is expected that construction will commence shortly. The first building to be erected will be a bridge building plant, 160 feet by 90 feet, and other buildings will be added as rapidly as possible.

The president of the company states that the new plant will be in operation by January 1, 1913.

## CANADA'S TRADE.

CANADA'S total trade for the past fiscal year amounted to $862,699,732, an increase of no less than $103,605,343, as compared with the preceding fiscal year. Imports totalled 547,382,582, an increase of nearly $86,000,000; exports totalled $315,317,250, an increase of nearly $18,000,000. The year's increase in trade—over 14 per cent., is one of the largest, if not the largest, in the history of Canada. According to present indications, the Dominion's trade for the current fiscal year will run very close to the billion-dollar mark.

**Imports and Exports.**

Of the total imports for the past year $335,204,452 were dutiable goods, while 186,144,249 were free goods. The Customs revenue totalled $87,548,252, an increase of $14,250,908.

Exports of domestic products for the year totalled $290,223,857; the principal items being:—Agricultural products, $107,143,375; animals and their produce, $48,210,654; mines, $41,324,516; forests, $40,892,674; manufactures, $35,836,284; fisheries, $16,704,678.

The increase in agricultural exports was approximately $24,500,000. In manufactures the increase was not quite half a million. Fisheries exports increased by a little over a million. On the other hand, there were decreases of a little over four millions in the exports of animals and their produce; nearly five millions in the exports of the forest, and a million and a half in mineral exports.

During the year Canada imported coin and bullion to the value of $26,033,881, as compared with only $10,206,210 for the preceding year.

## ECONOMY OF LIFTING MAGNETS.

THE economy resulting from the use of lifting magnets in large engineering and machine shops is illustrated, says the "Engineer," London, by the following details:—In one important ironworks, wagons were formerly unloaded by hand, and a 50-ton truck kept a gang of five men busy for four hours. After the introduction of lifting magnets, the unloading was accomplished in one and a half-hours. In large works, such a saving in the course of a year amounts to a considerable sum.

The portion of the magnet most liable to wear and tear is the pole shoe, which comes into direct contact with the material lifted; but as this is secured by bolts passing through the body, it can be easily removed when worn and a new part fitted. It is important to note that experience has shown the advantage of through bolts over cap screws or studs, which are liable to rust in and can then be removed only with difficulty. In addition to the works already mentioned, these lifting magnets are useful in foundries, blast furnaces, and rolling mills for lifting and transporting metal too hot to be handled. Castings can be readily handled which on account of their shape or unequal distribution of weight would require careful adjustment of hoisting tackle. Armor-plate and thin sheets of iron or steel used in the manufacture of pressed steel or iron car wheels and many similar finished articles, as well as raw products of foundries and machine shops can be readily and cheaply dealt with by electro-magnatic lifters.

## THE WARREN AXE & TOOL CO.

The Warren Axe & Tool Co., Warren, Pa., has voted an increase of its capital stock to $200,000 to take care of its growing business in axes and logging tools. It contemplates the erection this year of a factory at St. Catharines, Ont., for the manufacture of these products. The Canadian company will be known as the Canadian Warren Axe & Tool Co., Ltd., and will have a paid up capital of $150,000. The officers of the American company are: President, E.E. Allen; general manager and treasurer, H. P. Stone; secretary, W. A. Kinnear; superintendent, D. W. Murphy.

# CANADIAN MACHINERY AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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## WHAT DO YOU KNOW?

WHAT do you know? is a salutation expressive of a desire for suggestions and information from the work and experience of the party addressed, whereby the questioner may possibly enhance an already well developed intelligence and apply the information obtained to his personal profit and general usefulness. The same salutation would in many cases be an opening for the introduction of the latest gossip on the part of men as well as women, and would naturally have the reverse effect as regards acquirement and development of intelligence.

"What do you know" seems to us to imply the exercise of eye, ear and hand, each directed and governed by an active and reasoning brain system. Sub-dividing, we might call the exercise of ear and eye a well developed habit of observation, and that of the hand the instrument for putting it into effect. Illustrative of the point and something familiar to all of us, as a not altogether remote possibility, is a crowded street car going along at a good clip with the motorman just fallen in a faint. "What do you know" about controlling a street car, might be a very painful experience for you if a woman elbowed your fear-shaken frame to the one side and took charge.

A myriad other awkward situations might be cited as necessitous of silent observation and mental record, the majority of which may become apparent to the reader on a little reflection. Emergencies arise every day for the exercise of somebody's observation—"what somebody knows," and the trained man or expert may not happen to be there. As a matter of fact the irony of fate seems to rule it otherwise and the novice or amateur is called upon to avert or mimimize disaster and preserve life.

It is incumbent we think on the part of everyone, to cultivate a keen observation and perception of the conditions by and under which we live, not only with respect to our own particular and chosen calling, which, of course, must always have precedence, but in the various accessory features as well, that go to make a day's life and work. The man who observes most and knows most in his own particular line is the more likely to keep his eyes and ears open and alert for pointers in other fields, and while this latter is here perhaps given extra prominence, its inception and operation like charity must begin at home.

Interfering with the rights, privileges or professions of others is in no sense meant to be conveyed in the foregoing, because that particular species of "what do you know" needs no cultivation, being naturally innate, of luxurious growth and hurtful. What has been commended, is and will be helpful to ourselves and others when an emergency arises, and while we may not be as graceful and apt as the trained man, the result can be the same, thanks to "what we know" from cultivation of the faculty of industrious observation.

## WELL-SELECTED IGNORANCE.

THE call for well selected ignorance is a universally personal message to all classes and conditions of men. It takes for granted that from choice, indifference or circumstance, a degree of ignorance exists and is cultivated.

We are daily acquiring knowledge of some sort (being educated if you like) without much effort in its pursuit. Idle curiosity leads to its attainment, but it is knowledge of no moral and commercial value. A superficial smattering of the principles underlying one's business or occupation is also an acquisition of knowledge. Contentment with it, however, displays choice and cultivation of ill-selected ignorance; the antithesis of our subject.

We do not purpose here to treat the matter in its wider application, but rather to bring before our readers the fact that they have many superfluous frills in their trade get-up which a better-selected ignorance would tend to remove. Experience goes to show that men have an antipathy to let their equals know the extent of their knowledge, or put in another way and with the same meaning, the extent of their ignorance. Further, when opportunity offers by which valuable information is to be had for the asking, there is paraded that display of self pride whose inevitable result is, of course, ill-selected ignorance.

The picture drawn is no fanciful one and every reader can take it home to himself and say "that's me." We are all built that way, unfortunately, but need not as a consequence remain altogether and all the time under the thraldom. Get a beginning made, now, to help shake it off, by cultivating a well selected ignorance which is equivalent to the acquisition of a thorough detail education, involving the principles, the "whys and wherefores" of your business, and the grasp of every opportunity to add to it. It will save you many a hard knock, harder I assure you than the wounding of your pride by choice, to an inferior or equal. It will make a man of you as well as an expert operator, and if you cannot command success, you will at least deserve it.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

## Spur Gear Features

By G. D. Mills.

AN automatic gear cutter will cut tooth spaces on the circumference of a wheel with great accuracy, but rotary cuttters which have a range of two or more teeth, can only be perfect for the lowest number of teeth in the range. Thence it follows that in order to preserve the precision in spacing, and also the profile, a correct templet must be provided to finish the teeth, if a perfect wheel is desired. Unequal spaces between the teeth cannot be detected by looking at a wheel, nor can they be detected by calipering the width of the teeth. They can, however, be detected when the wheel becomes noisy and transmits a jerky motion. This is a sure indication that too much metal has been filed from some of the tooth faces; and while it is true that a pair of wheels will rattle a little when they are nearly worn out, this tendency cannot exist after a short service unless they were defective when first set up. A pair of true wheels will run smoothly and wear uniformly.

**Spokes.**

Respecting the proportions of the spokes in a wheel, the thickness of spoke should be 4-10 of the width and the taper ⅜ inch per foot per side. It is desirable to have full webs in wheels of 30 teeth and less, and a simple rule to determine the width of spoke in normal gears may be stated as:

$$\text{Width of spoke} = \frac{7}{P},$$

in which P equals diametral pitch. We are indebted to Mr. E. H. Wood for this formula, being an empiric formula of his calculations with respect to new gear spokes in Sibley Engineering, 1907, and while it serves as a most excellent guide in normal wheels, it should not be considered an absolute rule. If desirable to calculate spoke proportions, they may be considered as cantilevers loaded on the ends, and the load equally distributed on all the spokes.

In the example given, the wheels are required to transmit a load of 1050 lbs., and the cast iron gear has a pitch diameter of 9 inches. If we decided to use three spokes in this wheel, the length of each spoke would be about 3 inches, and the load on each spoke equals

$$\frac{1050}{3} = 350 \text{ lbs.}$$

We therefore have a cantilever 3 inches long, loaded on the end with 350 lbs., and the bending moment of this cantilever, therefore, equals 350 lbs. × 3 inches = 1050 inch pounds. The ultimate tensile strength of cast iron may be taken at 18,000 lbs. per square inch of section, and if we decide to use a safety factor of 6, the safe tensile strength of the material is 3,000 lbs. per square inch of section. The section modulus, therefore, equals

$$\frac{1050}{3000} = .35.$$

The width of spoke obtained by Mr. Woods' formula

$$= \frac{7}{P} = \frac{7}{4} = 1\tfrac{3}{4} \text{ inches},$$

and its thickness

$$= 1\tfrac{3}{4} \times \frac{4}{10} = .7.$$

The section is, therefore, 1¾ × .7, and the section modulus of a rectangular section in which the neutral axis is perpendicular to the longest side

$$= \frac{b \times d^2}{6} = \frac{.7 \times 1\tfrac{3}{4}}{6} = .3572,$$

in which b = short side and d = long side of rectangle. The section modulus obtained, therefore, agrees very closely with that obtained by considering the spoke a cantilever loaded on the end.

When the wheel is abnormally large, it may be necessary to depart from the rule, width of spoke $= \frac{7}{P}$, which serves as a guide in normal wheels, and determine the section modulus from the allowable unit stress in lbs. per square inch of material and the bending moment, as above, only. In this case, the dimensions of the rectangle would have to be found from the section modulus by means of the ratio of the width to the thickness of spoke, as embodied in the formula

$$d = \sqrt[3]{\frac{K \times 6}{\frac{b}{d}}},$$

in which K equals section modulus, and

$$b = d \times \frac{b}{d}$$

### SPOKE FORMULAE.

Width of spoke $= \frac{7}{P}$

Thickness of spoke $= \frac{4}{10}$ width

Load on each spoke $= \frac{\text{total load}}{\text{number of spokes}}$

$P$ = Diametral Pitch

$M$ = Bending Moment $= K \times S$

$S$ = Allowable Unit Stress of material in lbs per square inch $= \frac{M}{K}$

$K$ = Section Modulus $= \frac{M}{S} = \frac{b.d^2}{6}$

$b$ = short side of rectangle $= \frac{K.6}{d^2} = d \times r$

$d$ = long " " " $= \sqrt{\frac{K.6}{b}} = \sqrt[3]{\frac{K.6}{r}}$

$r$ = ratio of sides $= \frac{b}{d}$

Spur Gear Features.

The formulae are original, insomuch as they are the outcome of the necessary calculations imposed by the conditions of this article.

If we desired to preserve the ratio of thickness $= \frac{4}{10}$ of width, the formulae reads:

$$d = \sqrt[3]{\frac{K \times 6}{.4}}, \text{ and } b = d \times .4.$$

The formulae serve a most useful purpose in this case, and are equally so for similar conditions. I have devised a companion formula in which the neutral axis is perpendicular to the short side, which will be published later in book form. The formulae devised for spokes may be stated as follows:

The ultimate tensile strength of cast iron as above is 18,000 lbs., and a safety factor of from 6 to 10 should be used. In the above comparison, a safety factor of 6 was used, but in large wheels it would perhaps be safer to adopt 10 instead of 6. The ultimate tensile strength of steel is 60,000 to 65,000 lbs. per square inch, with which a safety factor of 3 or 4 should be used. The safe tensile strength of cast iron is, therefore, 1,800 to 3,000 lbs. per square inch, and that of steel 15,000 to 20,000 lbs. per square inch.

**Results From Comparison of Values.**

In comparing the values obtained by the Lewis formula for the strength of gear teeth with the shearing value of the metal in one tooth, I have obtained the following with respect to the pair of wheels in the example given in this article. For the pinion, the compressive strength of steel and high test iron may be assumed as 13-15 of its tensile strength, and its shearing strength at 5-6 of its compressive strength. If we take the safe tensile strength of steel at 10,000 lbs. per square inch, using a safety factor of 6 for varying stress, its compressive strength = 13-15 of this, or 7,666 lbs., and its shearing strength 5-6 of 7,666 lbs., or 6,385 lbs.

The average shearing area of the tooth may be assumed as the chordal width × face length = .3915 × 2 = .783 square inch, and the shearing strength of the metal in one tooth = 6,385 lbs × .783 square inch = 5,000 lbs., which is well over that obtained by the Lewis Formula of 2,419 lbs. For the cast iron gear, the shearing strength of cast iron is equal to its tensile strength. A safety factor of at least 10 should be used for varying stress. The ultimate tensile strength of cast iron being 18,000 lbs. per square inch, its safe tensile strength is 1,800 lbs. per square inch, and its safe shearing strength is the same. The shearing area of tooth as before = .3924 × 2 = .7848 square inch. The caliper width for the gear being .3924 inch, and for the pinion .3915 inch, the shearing value of the metal in one tooth of the gear, therefore, = 1800 lbs. × .7848 sq. in. = 1412 lbs., which is nearly the same result as obtained by the Lewis Formula, in which a value of 8,000 lbs. was used for cast iron. In view of the fact that this value steadily decreases as the speed increases, we may, therefore, assume that the Lewis Formula is all right, since we have compared the shearing value of the metal in one tooth without regarding the speed of the wheels, and have obtained nearly the same result for cast iron as the Lewis Formula, with its highest factor and lowest speed.

The angle of pressure on all involute gear teeth is always more or less oblique, depending on the angle of obliquity of the teeth. The load transmitted on the teeth when interchanging is always applied on the line of pressure, and is never applied at right angles to the tooth; while in cycloidal or double curve teeth, the pressure angle determined as for involute teeth, changes constantly when the teeth are interchanging; the load being transmitted on the teeth in a variety of directions. The pressure angle, therefore, determined for involute teeth, is all that the term implies, and for cycloidal teeth it is not. Involute teeth transmit unvaryingly angular velocity and cycloidal teeth do not.

From the preceding it will be seen that the selection of the chordal width of involute teeth to determine the average shearing area is a liberal one, as any one tooth cannot receive the full load only at or near to the pitch circle, and in an oblique direction. Again the point of a tooth will never be subjected to the strain of the entire load, unless the tooth spaces are unequal; because when the point of one tooth begins to engage the flank of its mating tooth, the preceding tooth is receiving the full load obliquely at or near to the pitch circle, if the wheels are true. While the tooth is not subjected to a direct shear, which may be taken to mean a piece of metal held firmly and subjected to a load which has a tendency to shear or cut, it is subjected to a similar oblique strain; therefore, the Lewis formula provides a strength equivalent to the average shearing value of the metal in one tooth, without regard to the speed.

## A BABBITTING FIXTURE.

By D. O. Barrett.

THE bearing shown in Fig. 1 is for the crank end of the connecting rod of a gas engine, and is a brass casting with a babitt liner cast in, the outer half being slightly less than complete

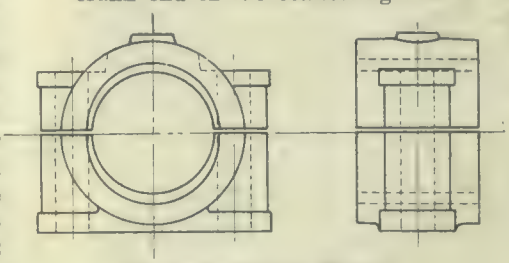


Fig. 1.—Babbitting Fixture.

to allow for adjusting shims. The fixture, Fig. 2, is provided with a half round arbor dowelled to the base casting and the brass is located by means of the pins fitting into the bolt holes,

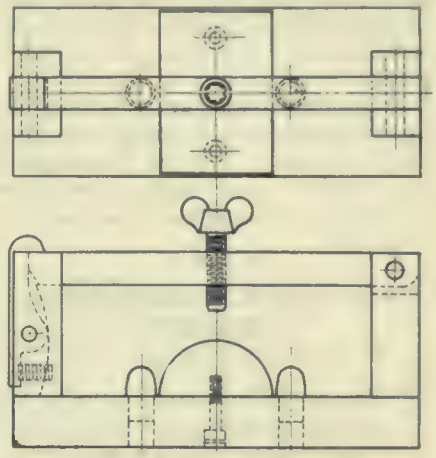


Fig. 2.—Babbitting Fixture.

which are first drilled. The bar at the top is pivoted at the one end and held by the spring latch at the other, while the screw at the centre ensures the brasses being properly pressed down.

Wooden pieces cut to the half round are held at the outside of the brasses with a patternmaker's clamp; one of these being provided with a vent, and the other with the pouring gates. When the outer half is poured, strips of wood the same thickness as the shims desired are slipped over the pins.

## MAKING THREAD CHASERS.

By A. Leonard Marshall.

HAVING a large number of brass studs ¾ by 4 inches to make on an engine lathe I used the chaser shown in

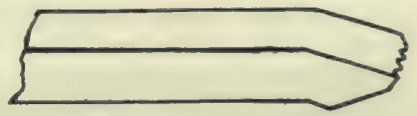


Fig. 1.—Making Thread Chasers.

fig. 1, and found that by so doing I could make the tool and thread the studs in one third of the time allowed for the job.

To make the chaser, I centred a ¾ tap in the lathe, and used it as a hob. After

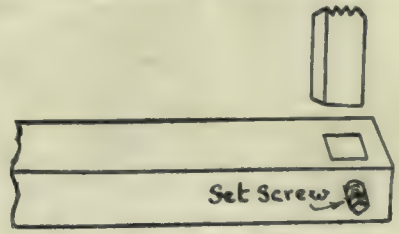



Fig. 2.—Making Thread Chasers.

getting a piece of tool steel annealed and offset as shown, I secured it in the tool post and geared the lathe for 10

threads per inch. I then fed the tool against the hob, while the carriage was advancing, until I got a full thread. I next raised the tool a little and repeated the operation to give the tool clearance. The next step was to chamfer the first few threads and temper. Three cuts only were required to cut a full thread in brass.

Large pipe flanges are now being successfully threaded in our shop by using the tool shown in fig. 2. The chaser is made of high speed steel and is secured in the tool holder by a set screw.

## REPAIRING A CHATTERING PULLEY.

By J. H. R.

THE sketch herewith shows the method adopted some time ago in repairing a loose pulley, which would persist in chattering when running, either with or without the belt.

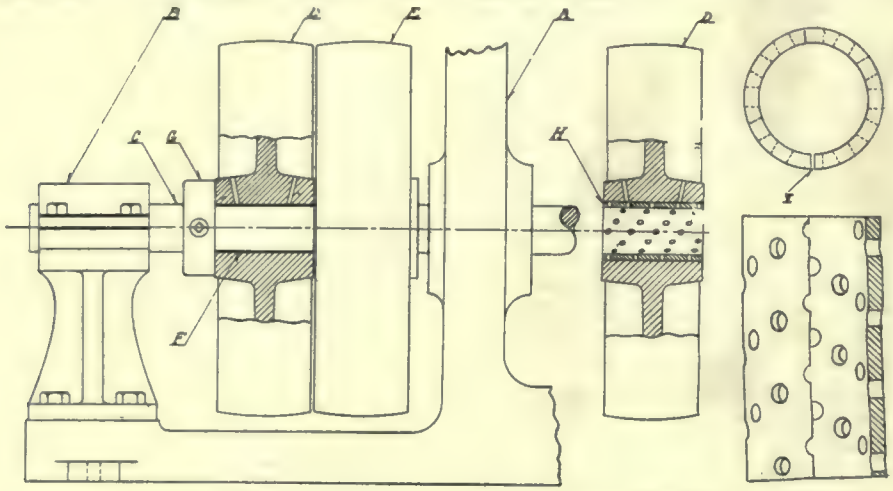


Fig. 1. Repairing a Chattering Pulley.



Fig. 2. Fig. 3.

The shaft (C) was in such a position that it was not very convenient to remove it from the machine, and as the part (F) was worn nearly a 1-32-inch below original size, although comparatively round, it seemed a difficult matter to remove the play between the shaft and the pulley. This latter amounted to considerably over 1-16 of an inch; the pulley being worn slightly more than the shaft.

### Detail of Repair.

The housing (B) was removed, the loose pulley taken off and bored out to receive the bush, fig. 3. The bore of the bush was made a shade loose for the worn part of the shaft (F), and a sliding fit in the loose pulley. The bush was then slotted the entire length, as shown in fig. 3; numerous holes being drilled about the circumference and filled with lubricating grease. It was afterwards sprung over the large part of the shaft to its position at (F), the shaft being about 2¾ inches diameter, and the bush about ¼-inch thick. A brass liner was placed in the slot (I) and the pulley slid over the bush.

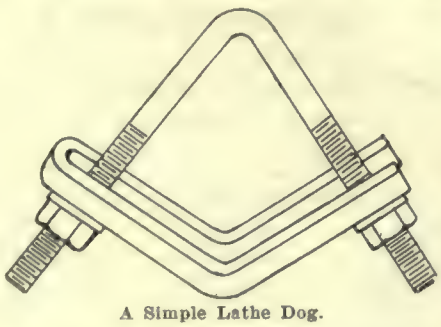
With the putting-on of the belt the result was highly satisfactory.

## A SIMPLE LATHE DOG.

By T. R.

THE lathe dogs listed by manufacturers of such goods are made in certain definite sizes; consequently the machine shop must be equipped with all sizes and with more than one of each size if many lathe hands are employed. Sometimes when a job is to be turned, you may find that you have not a dog that will fit the part to be driven, and in such a case the device here shown will prove most useful, as it may be quickly and cheaply made up to suit any size of work.

Take a piece of 1½ inch iron or steel, 16 inches long, and bend it into the shape of the letter (U); the width between the legs being slightly more than ½ inch. Then, at a point half way up the (U), bend the two legs forward through angles of 90 degrees. Next, take a piece of ½-inch rod, 16 inches long, thread it for 4 inches at each end, and bend it through an angle of 90 degrees from its middle point. All that now remains to do is to assemble the device with two nuts and washers, as shown in the cut.



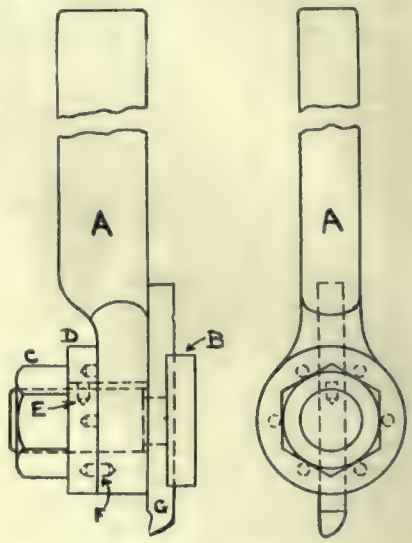
A Simple Lathe Dog.

## HANDY PLANER TOOL.

By W. A. P.

THE accompanying illustration shows a tool that has proved very handy for planer use.

A is the stock; B the clamping bolt and C the nut. The dowel pin E is driven tight in the bolt B, and fits in a keyway cut in the washer D, and also in the stock A. Another dowel pin F is driven into the stock A, and the washer D is drilled with a number of holes to fit same as may be seen in the front view. By means of these holes the cutter G can be positively set at many different angles. The cutter passes through a square hole cut in the body of the bolt B, as shown.




A Handy Planer Tool.

## LOOSE PULLEYS.

By Donald A. Hampson.

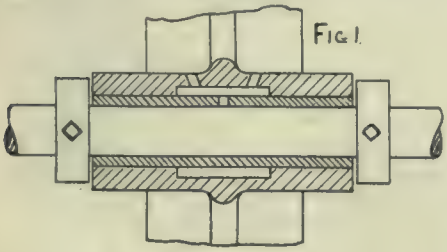
THE loose pulley problem is not a new one, but like the poor, is always with us. In the machine shop, the question is not so serious as in the wood-working shop; but it nevertheless demands attention.

Automobile builders in their instruction books are unanimous in affirming that the greatest repairer is the oil can. The same remark might be applied to the loose pulley, with the corollary that "given an oil can, a free passage-way for the oil must be provided." On account of a blockade of dirt, too much of the oil poured into an oil hole often backs out, and perhaps falls on the head of some innocent victim below. Another difficulty which the oil-can has to overcome is caused by the lack of recesses or grooves at the bottom of the hole. One squirt of the can emits a 20-drop stream that is directed at a 5-drop hole, whereas a drop in the right spot is worth a flood in the wrong.

In the writer's opinion, one of the most serviceable types of construction,

having regard to relative low first cost and cheap renewal possibilities, is shown in Fig. 1. The hub of the pulley is bored and bushed with a thin cast iron liner, reamed very smooth and having on its inside a shallow spiral groove, making about one turn to the inch. This groove is fed by an oil hole which leads out of a rough bored recess in the hu of the pulley. Provided that the oil holes to the outside are kept in a passable state, conditions are very favorable to a long life for this arrangement, since there is a sufficient reservoir with a small outlet; the latter feeding oil through the spiral groove to the ends of the hub, lubricating the shaft as it passes, and driving out air before it. Collars should be set as shown, in order to give the pulley a little end play on the shaft. A total side movement of ¼ inch will be sufficient and a gratifying freedom from early trouble may be expected.

While doing some work in a woodworking plant, the writer came across, what was to him, a new design of loose pulley. This is shown in Fig. 2 and it will be seen that the pulley has two bushings; one, (B) of bronze next to the shaft and one, (A), between the bronze bush and the hub. Bushing (A) is of cast iron and is pressed into the the hub. Bushing (B) is a running fit on the shaft and in the cast iron bush-



Loose Pulleys.

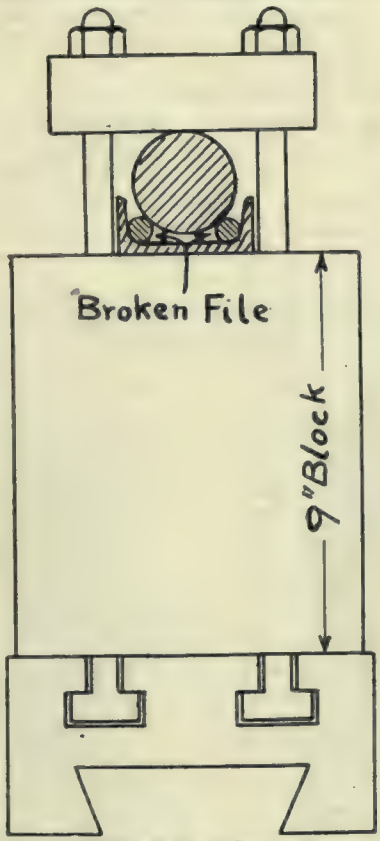
ing. On the outer surface of (B) are turned two grooves, each of which has several oil holes leading to the shaft. Oil holes through the hub and bushing (A) meet these grooves.

This design of pulley was in use on several machines in that particular shop and was giving splendid service under more than usually severe conditions. In theory the various units turned as a whole, until possibly things at the centre got warmed up to an unusual degree, when the inner bushing commenced to turn within the outer, and continuing to run thus, gave the shaft a chance to cool off, after which it resumed its normal function.

## BORING A HARD CASTING.

By J. C. M.

I RECENTLY had a very hard casting to bore out in the lathe and was unable to use an ordinary boring bar



Boring a Hard Casting.

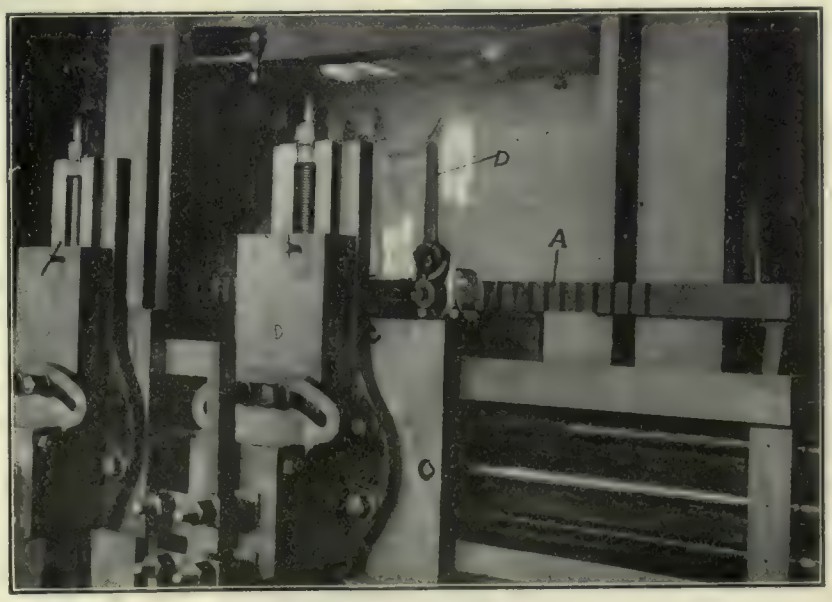
clamped in the tool post on account of a projection on the casting, which necessitated the lathe centres being raised 9 inches in order to swing the job. I raised the height of the slide rest a corresponding amount by placing a 9-inch block on top and clamped the boring bar to this with vee blocks. However, the casting was so hard that I found it impossible to prevent the bar from turning in the vee blocks, so I had to look around for some other means of holding it. Having read how a piece of round file makes an ordinary monkey wrench into an efficient pipe wrench, it occurred to me to use the same scheme for securing the boring bar. The illustration shows how it was done. I cut off two pieces of 3-inch channel iron, each 4 inches long, and placed them across the block. I then got two broken round files and put them in the corners of the channel as shown. All that then remained to do was to put the bar in place on top of the files, making sure that the bottom cleared the channel iron when clamped. This device proved entirely successful.

## A RACK PLANING ATTACHMENT.

By Avery E. Granville.

THE attachment shown has proved very efficient for use in spacing the planer tool, while planing steel racks of a certain pitch. Two brackets hold the spacing bar (A) fast to the planer cross-rail, and a bracket (B) bolted to the cross-slide, carries an indexing pin (C), which is worked by the cam lever (D) and a spring inside of the bracket. In the position shown, the pin is out of the way of the notches in the bar, and the cross-slide may be moved as desired; but if the lever (D) is pulled to the right, the cam drops away from the small pin (E), and the indexing pin is left free to spring into the next notch that it passes.

This method is far more accurate than trying to space by turning the cross-feed screw a certain number of times,



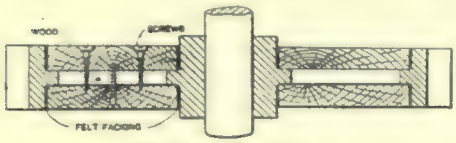
A Rack Planing Attachment.

and the time taken bears no comparison. Of course, in using this attachment we do not plane just one rack at a time, but, as a rule, place about twenty on the planer table at once.

## KINK FOR NOISY GEARS.

From Practical Engineer, London.

THE gearing of a crane was placed in such a position that the noise resulting from its operation became highly




Kink for Noisy Gears.

objectionable. Several schemes were adopted to eliminate it. Grease and oils of all kinds were used, with but temporary success. Finally the following method was tried:—The annular space between the hub and the rim was packed with wood, which butted tightly up against felt pads as shown in the illustration. The pieces were secured to each other by ordinary wood screws, care being taken not to have the heads project. This method eliminated the objectionable noise.

It might be added that good hardwood should be used, also rubber, to advantage instead of felt, unless for exposed outdoor work.

## QUICK REPLACE JOB.

By H. A. Wilson.

LATE on Friday evening a telegram arrived at Picton, Ont., from Windsor Mills, N.S., ordering a pinion to replace one which we had supplied some years ago. This pinion had a twelve-inch face and mated a bevel mortise gear. As our original pinion and gear patterns were designed for a face of eight inches only, we had extended temporarily the face, arms, hub, etc., to meet the above requirements. The pattern had been dismantled, however, to fill a simultaneous rush order for a gear in its original condition, namely eight inches face.

I came down early on Saturday morning and had the men clear the foundry floor, as we had run-off a cast the last thing on Friday night. The eight inches face pinion was molded in the morning and the cores made for both gear orders. At noon, the pattern was in the pattern room again, and at one o'clock, the patternmaker started to put on the additional pieces to make the pinion 12 inches face. He was finished at 1.45 p.m. The pattern was again in the foundry a few moments later, and by six o'clock the same evening, the gears were cast.

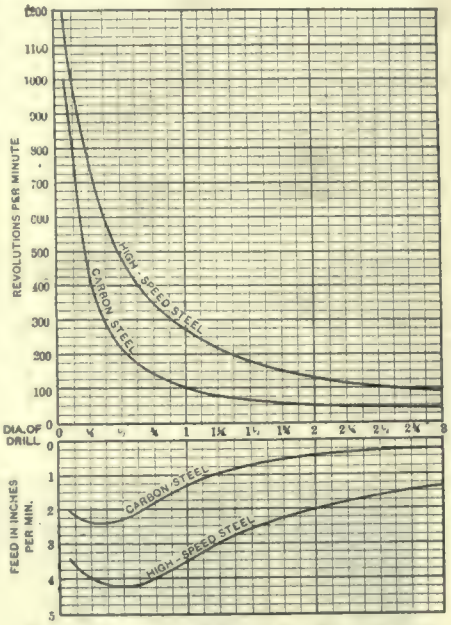
The Lord's Day Alliance prevents Sunday labor, so at 4 a.m. Monday, the gear was hanging in the crane being cleaned and chipped. We could not work at it on Saturday evening because the casting was too warm. By 6.30 a.m. Monday, it was in the lathe, being bored 4 5-16 inch. diameter, and having the hub faced on both ends, rim turned and keyseated. The teeth were then cut, and the gear shipped on Tuesday night.

The dimensions were:—

Circular pitch ..... .....2.9 inches.
Face ..... ..... ..... ..... ...12 inches.
Bore ... ..... ..... ..... ..... ... 4 5-16 inches
Keyway ..... ... ... ..... ..... ½ by 1 inch
Weight ..... ..... ..... .....714 pounds.

## CUTTING SPEEDS AND FEEDS FOR TWIST DRILLS.

THE accompanying diagram devised by E. G. Wrigley & Co., Birmingham, England, gives speeds and feeds applicable to ordinary practice for high speed carbon-steel twist drills, when drilling mild steel. As the values given are not experimental or test rates, but

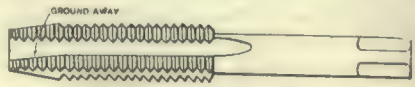



Cutting Speeds and Feeds for Twist Drills.

intended for everyday practice, they may, of course, be exceeded under favorable conditions. It is, however, generally desirable to keep the cutting speed comparatively low, so as to avoid overheating of the drill point, and consequent waste of power.

## COLORING FOR PIPES.

THE uniform system of distinctive coloring for pipes in industrial plants, proposed some months ago in Germany, is being received with favor. It includes green for water, yellow for gas, blue for air, white for steam, black for tar, rose for lye, brown for oil, grey for vacuum, rose with red streaks for acids. A fuller indication of the contents of the pipes, pressure, temperature, impurities or admixtures is effected by a combination of the basic colors with stripes of red for danger, black for impurity, white for presence of steam, green for presence of water. The




Tap for Hard Metal.

direction of flow is indicated, if necessary, by arrows.

The same colors may be used in drawings, steam being indicated by fine double lines. The colors on the pipes are indicated by securely attaching to the pipes small painted and enamelled or varnished strips of iron 3 to 4½ in. wide.—Ex.

## TAPPING HARD METAL.

From Practical Engineer, London.

WHEN hard metal has to be tapped, it is very common for the tap to break. If the tap is ground, however, as indicated in the engraving, no difficulty will be experienced. The effect of the grinding removes the front part of the teeth, so that the cutting edge presented forms a different angle with the thread than on the section not ground away. This method of grinding the tap proved successful in tapping very hard rolled steel plates.

Beginning with its June issue, The Merry Molder, published by the Osborne Mfg. Co., Cleveland, will award each month a prize of $10 in cash for the best paper on foundry practice written for that publication. The contest is open to all shop readers of the Merry Molder, including superintendents, foremen, moulders and laborers. The paper must discuss some example of improved foundry practice in which the improvement has been accomplished by an Osborne machine or accessory.

The method of producing fine brass castings in the leading brass centres of the United States, is to face the mold with Windsor Locks sand, then skin dry the mold and finally smoke the face with a gasoline torch. Except for undercut work it is not customary to dry the mold clear through, or to use French molding sand. The latter is employed for molding statues and similar work requiring false cores.

# DEVELOPMENTS IN MACHINERY

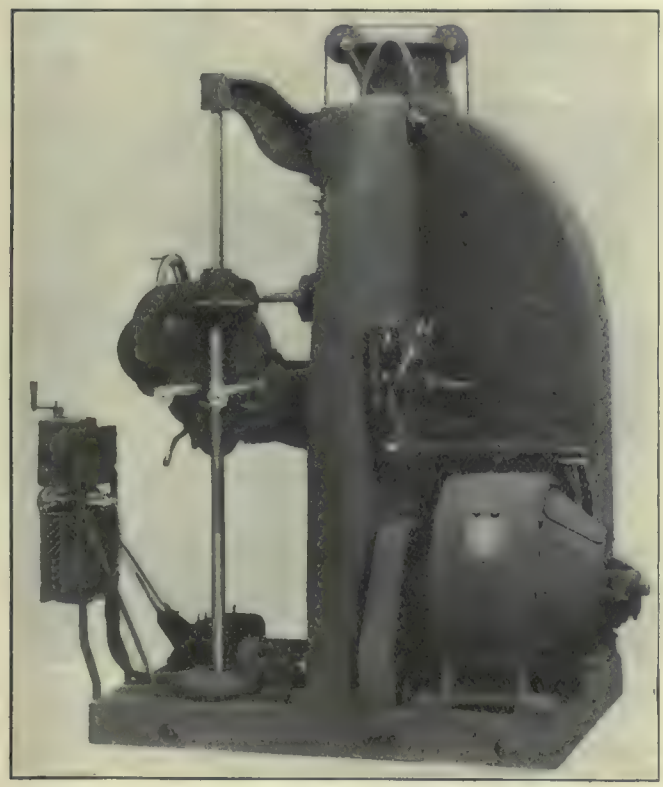
A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

## SPECIAL REAMERS FOR LOCK GATE CONSTRUCTION, PANAMA CANAL.

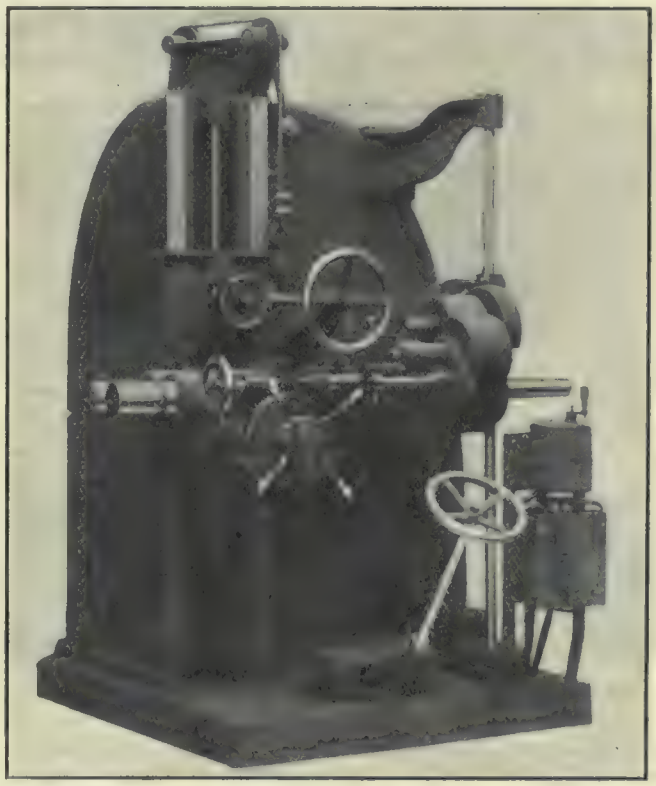
FOR the final riveting of lock gates, the skeletons and sheathing of which have been put in place at Gatun, the McClintic-Marshall Construction Co. has installed 8 special electric reaming machines. Each machine, which weighs 6 tons, carries two spindles, mounted on a heavy cast base and driven by a 10-horse power induction motor. That the machine may be carried over the face of the gate, it is mounted on a broad, adjustable scaffold, extending the length of the gate, supported by chain-blocks from brackets affixed to the gate top. Some of the holes on the upstream face of a gate are enlarged to a diameter of 1 1-16 inches, and others to 15-16 of an inch, and those on the downstream face are made 15-16 of an inch.

These machines are now in use on the main gates of the upper lock at Gatun, and will later be used on all of the gates in the three sets of locks. They were designed by the Foote-Burt Co. of Cleveland, Ohio, especially for this work, and the distinguishing features are great power, 9 speeds, from very slow for heavy drilling to very high for lighter reaming, and fixed spindles arranged to suit the uniform spacing of rivet holes in the lock gates. On test, one of the machines drilled 1 1-16-inch holes through 1-inch plate in four seconds, being at the rate of 15 inches per minute. It is estimated that each machine is capable of doing the work of five of the usual type of portable reamer.

The complete machines, mounted on four wheels, these latter, in turn, being mounted on bearings, were racked along by a hand wheel located in front. The spindles were elevated by another hand-wheel for this purpose, also located in front.



Rear View of Special Reamer for Lock Gate Construction, Panama Canal.



Front View of Special Reamer for Lock Gate Construction, Panama Canal.

## INTERNAL GRINDING MACHINE.

AN internal grinder of interest to automobile manufacturers, makers of roller bearings, and to any manufacturer who has occasion to use such a tool, has recently been placed upon the market by the Brown & Sharpe Mfg. Co., Providence, R.I. It is known as the No. 22 Internal Grinding Machine and the two accompanying views show plainly many details in construction as well as its general characteristics.

**Design and Purpose of Machine.**

This machine is designed to meet the requirements of all varieties of internal grinding that can be revolved within its range. Holes from 2½ to 12 inches diameter and 8 inches deep can be ground, and the machine will swing 18 inches. With a special spindle, holes less than 2½ inches diameter, but not exceeding 12 inches deep, can be ground The machine is particularly adapted to grinding holes in hardened steel gears, cutters, collets, bushings and similar classes of work. Taper holes can be ground as easily and accurately as those that are straight; and work, such as the facing of recesses in automobile gears to obtain a bearing true with the hole, can be done without removing the piece from the machine.

The result of extensive experience in the construction and use of various kinds of grinding machines and of careful study into their particular requirements is evident in this design. The various parts are so arranged and constructed that extreme accuracy may be secured in work produced; efficiency and convenience being equally prominent features. In this machine, the work speeds and table feeds are completely

separated; an important factor in commercial grinding. By this arrangement it is possible to obtain a correct table feed for any work speed; thus, when it is desired to remove stock rapidly, a slow speed and fast speed are available. Both work and table feeds are started and stopped by a single lever located at the front.

All wearing surfaces are adequately protected; the ways of the bed being always covered and the oil holes protected from grit and dust. All screws, bolts, and nuts requiring frequent adjustments are hardened. The handwheels and levers for controlling the various movements are all placed at the front.

**Spindle Speeds, Stand and Slide Details**

An ample range of independent spindle speeds is obtained by the use of interchangeable split pulleys on the intermediate shaft at the back of the wheel stand, and an idler pulley is provided to keep an even tension on the belt and take up slack due to the use of pulleys of different diameters. Three split pulleys are furnished, providing for speeds from 3,990 to 7,300 revolutions per minute. The wheel stand and slide are both of heavy, rigid construction, capable of resisting vibration which would lead to inaccuracy in the work. The wheel stand swivels, thus permitting the spindle to be set at an angle when grinding the face of cutters or automobile gears. This feature is also convenient when a hole has been ground and it is desired to grind the face of the work before removing it from the machine. Transverse movement of the slide is obtained through a worm and wheel actuated by a hand-wheel at the front of the machine. When desired, an automatic cross feeding mechanism similar to that found on all B. & S universal and plain grinding machines, can be furnished.

**Headstock.**

The headstock, of rigid design and firmly fastened to the swivel table by means of bolts that slide in a T-slot, swivels, and can be set at any required angle; the amount of adjustment being indicated on the graduated dial on the base. The spindle is hollow and runs in bronze boxes provided with means of compensation for wear. It can be locked in position when removing the face plate, chuck, or an attachment.

Another valuable feature is the belt tightening device shown over the pulley. This consists of a small pulley mounted on a bracket that can be drawn forward or pushed back by means of a handle. When drawn forward, a tension is brought upon the belt, causing the spindle to revolve and drive the work, and when pushed back the spindle may be quickly brought to a stop for changing the work or easily revolved by hand when centreing a piece. A range of 12 work speeds, varying from 40 to 340 revolutions per minute is provided.

**Sliding Table.**

The sliding table is of rigid construction and its bearings are scraped to fit the ways in the top of the bed which are aligned with master straight edges. The travel of the table is automatic and entirely independent of the speeds of the work and wheel. It is controlled by adjustable dogs on the front of the table that operates against the reversing lever. The dogs can be raised and the table run beyond the reversing points without disturbing their adjustment; a valuable feature when withdrawing the work from the wheel. When the work is finished, the trip dog nearest the wheel is raised, the table then moves to the left until the power feed automatically disengages. It may then be moved farther away by the large hand wheel. After a new piece of work is put in, the table is moved up by means of the hand-wheel until the work nearly reaches the wheel when the power feed automatically engages again.

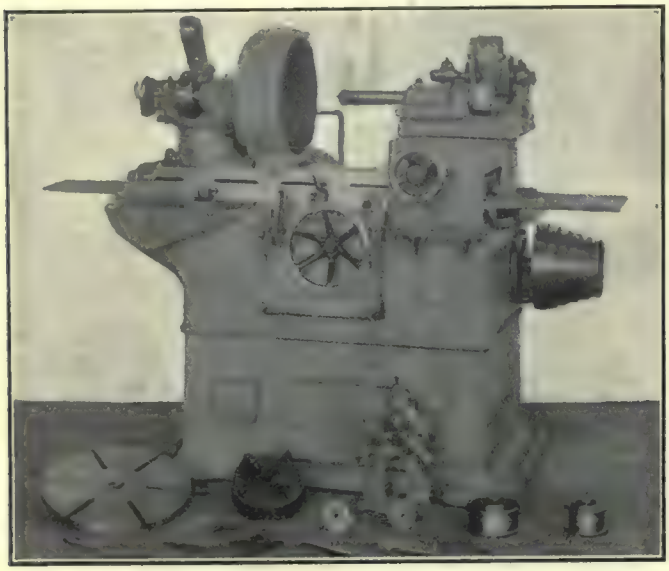
**Provision for Wet Grinding.**

The soda water is pumped from a tank located in the bed and is fed to the wheel through the hollow work spindle. The pump consists of a simple fan revolving in a case, and, as it is immersed at all times, no packing is required. The tank is readily accessible for cleaning. The hood or water guard shown on the machine is furnished for covering the work.

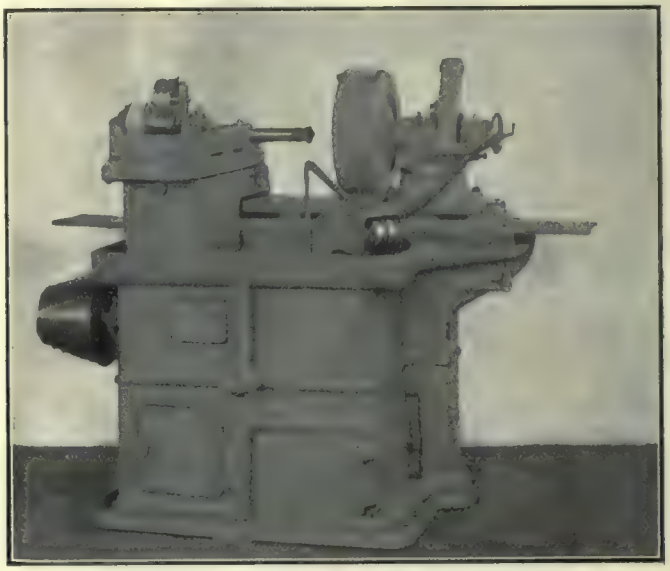
In other details the construction of this machine differs but little from that of B. & S. universal type. The swivel table, however, pivots on a stud located beneath the headstock, making a long leverage from that point to the end; thus enabling very fine adjustments to be made in setting to grind straight or in bringing a taper to the exact angle after the headstock has been set as closely as possible by the graduations on its base.

There are six changes of table feed, varying from 15 to 48 inches per minute, available for any work speed.

The equipment furnished with the machine is shown about the base in the front view, and also includes the overhead works which are not shown.



Brown & Sharpe No. 22 Internal Grinding Machine.



Brown & Sharpe No. 22 Internal Grinding Machine.

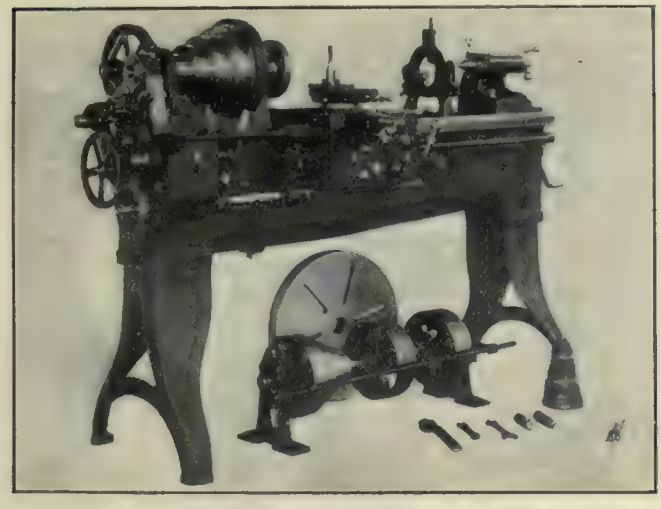
## 14-24 INCH SLIDING EXTENSION GAP ENGINE LATHE.

THE Barnes Drill Co., Rockford, Ill., have recently put on the market a 14-24-inch extension bed gap lathe, particulars of which will doubtless be of inter-

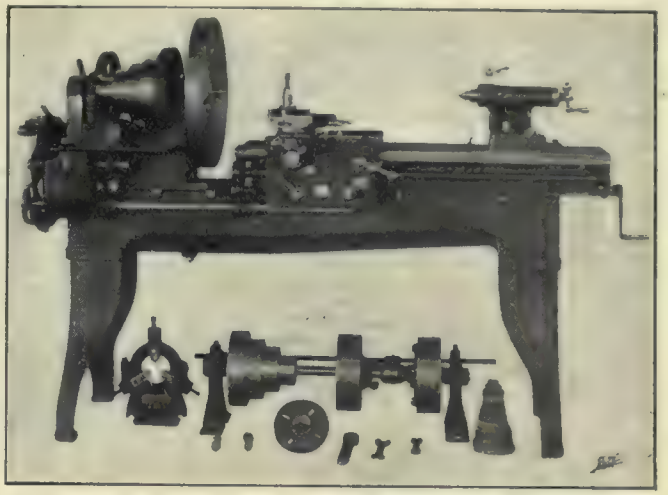
est to our readers. Notable improvements over the firm's 13-22-inch machine include a larger spindle—2 15-16-inch, taking 1½-inch stock through same; cone diameter increase to give strong driving power; geared feed box giving six quick changes of geared feed; strengthening of compound parts and heavier tail stock spindle.

The lathe is a strong, well built tool adapted for automobile garage and general repair work, and is being used extensively for these purposes. It also makes a very convenient tool for fitting and assembling work in factory machine shops.

A self-contained motor drive is a feature of the equipment and for this purpose a 2 h.p. motor, running 1,200 r.p. m., is recommended.



14-24 inch Sliding Extension Gap Engine Lathe.



14-24 inch Sliding Extension Gap Engine Lathe.

and will handle a wide range of work. The sliding top bed will be found an indispensable feature for many jobs, especially on general repair work, because it permits you to swing pieces of larger diameter through the gap, and of greater length between centres, than is possible on an ordinary 14-inch lathe.

This machine has the necessary strength and power to turn full diameter of swing in the gap, and at the same time is free from any awkward or objectionable features for use when the gap is closed. A taper attachment when so ordered, is furnished at extra cost. The lathe is especially well

## AUTOMATIC FEED WEDGE GRIP RIVET HEADER.

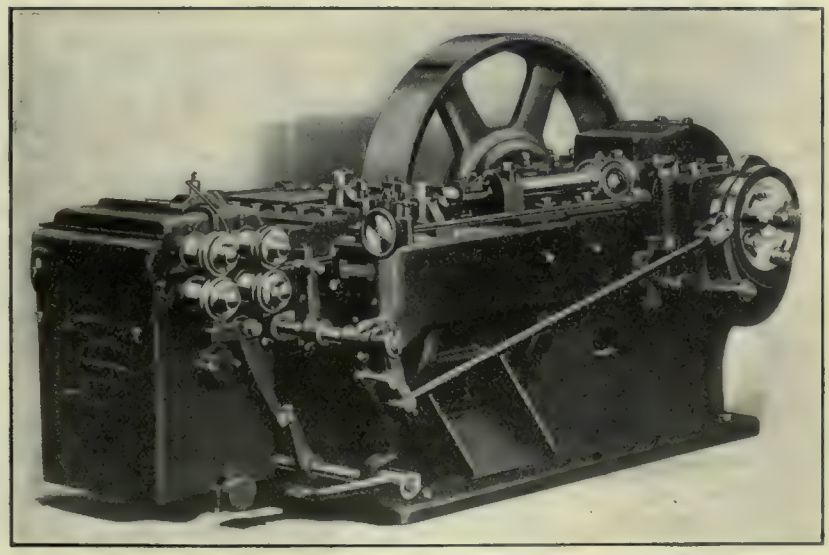
THE National Machinery Co., Tiffin, Ohio, originators and builders of bolt and nut machinery, are devoting considerable effort to the development of automatic and semi-automatic equipment of this type, with a view to eliminating the excessive manual labor required in the operation of rivet machines, bolt headers, nut tappers, etc. Experience shows that the operator is subject to great body fatigue, which results in decreasing his efficiency or productive capacity, and consequent losses in output.

We illustrate herewith a new design of automatic feed for National Wedge Grip Rivet Headers, which has recently been perfected by this company, and which embodies some novel features. In this machine, long rods in mill lengths, taken on the initial heat from the finishing rolls or reheated in special long furnaces, are started into the feed rolls by the operator; the rod being advanced automatically, a blank sheared and headed, and a finished bolt or rivet ejected at each revolution.

Single-blow bolts, rivets, track bolts, or any type of "single-blow" work can be made in this machine, and the "Wedge" gripping mechanism insures a product free from swollen shanks or objectionable fin along the body, as the dies cannot "spring" or give during the upsetting. The feed rolls are chilled castings and are water-jacketed; thus maintaining an even temperature and insuring minimum wear on the feeding surface, hence positive and uniform "feeding."

A new type of stock gauge is employed which is designed not only to allow rapid and minute adjustment while the machine is in operation, but also to eliminate "spring" and thus secure high uniformity in the quality of the product. In plants where these headers are operating, outputs are secured 50 to 100 per cent. larger than obtainable on the hand-feed machine, and due to the accuracy and uniformity in "feeding;" a better quality of output also is secured on the automatic feed header.

The Wedge grip rivet header with automatic feed is built in 1, 1¼ and 1½ inch sizes, illustrated descriptions of which are to be found in Circular 1016, issued by the National Machinery Company.



Automatic Feed Rivet Machine.

# FOUNDRY PRACTICE AND EQUIPMENT

**Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.**

## MOULDING A CONDENSER SPRAY PLATE.

By J. H. Eastham.

THE circular casting shown in plan and cross section views at Fig. I. was required for condensing purposes; being in effect a plate pierced by 3,500 holes, each tapering from 5-16 to ¼-inch. Six ribs, cast on the upper side, to strengthen the piece, tapered in depth from 2½ to ¾-inch. The small holes running through the casting each terminated on the under side in a small boss; ¼-inch metal being allowed round each hole.

The cost of a complete pattern being considered out of the question, a corebox, one-sixth section of the full radius,

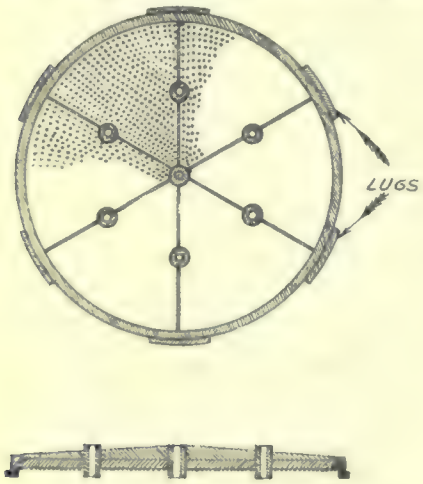



Fig. 1—Condenser Spray Plate.

was first made; each slab or section of core being indented by some 580 small prints, in which to paste the cores to form the small taper holes above mentioned. A small corebox to turn out four of the round cores at each operation was handed to a boy, who, after making the 3,500 needed, dried and pasted them into the prints in the slab cores. The six sections were then shelved till needed by the moulder. The sweep shown at A, Fig. 2, was fitted to a spindle, and used to strike out a bed on which to lay the rib pattern and ram up the top impression; the sunk parting indicated at B, being necessary, as the cope part, C, was of ordinary straight barred type.

In Fig. 3, the rib pattern with rough battens nailed on to avoid breakage or ramming out of shape, is shown laid on the parting, with empty cope in position ready for ramming. One inch of facing sand was spread inside the arms; gaggers and wooden soldiers being employed to carry the lift. The cope was then rammed-up and staked in the usual way. The ribs were hoisted away with the top part, by means of a couple of wood screws, as is usual in the case of loose

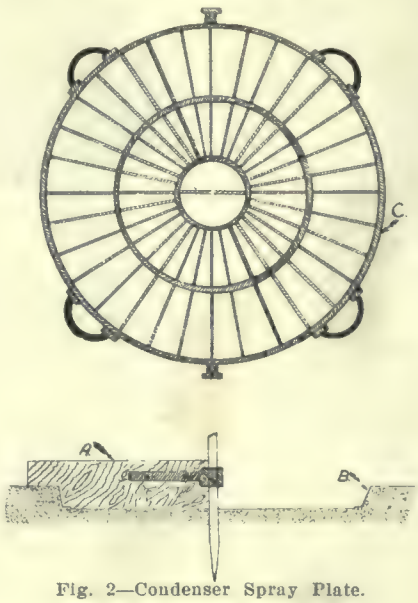



Fig. 2—Condenser Spray Plate.

pieces or coreprints on the upper side of patterns.

The cope being removed and the mold drag dug out, the strickle, with additional piece screwed on, was again used to sweep out the extra depth required as coreprint, the sloping parting being kept good, as shown at F, Fig. 4. The six lugs or short flanges shown in Fig. I. were now bedded-in and drawn inwards from one pattern, the mould overhanging them being well nailed to prevent any crush when trying on the cope. The bottom mould was now ready for the section cores. These having been set, the

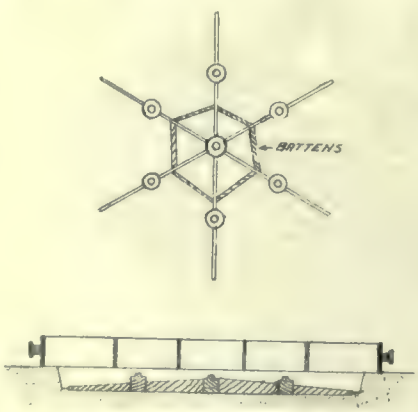



Fig. 3—Condenser Spray Plate.

cope was scraped to remove any irregularities caused through ramming; the few protruding soldiers knocked back below the surface, the face sleeked over, the arms drawn out and finished, and plumbago blacking spread over the whole surface.

A wash over with molasses water and a little skin drying were now considered advisable. The mould was, therefore, suspended over a fire of shavings for this latter purpose, whilst the 2-inch round cores through the seven bosses were placed in position. The cope was next tried on, and being found to touch the small cores all over the mould fairly accurately, was closed finally, weighted, and the piece cast without mishap.

One-third of the plan view of the closed mould at G, Fig. 4, is left open to

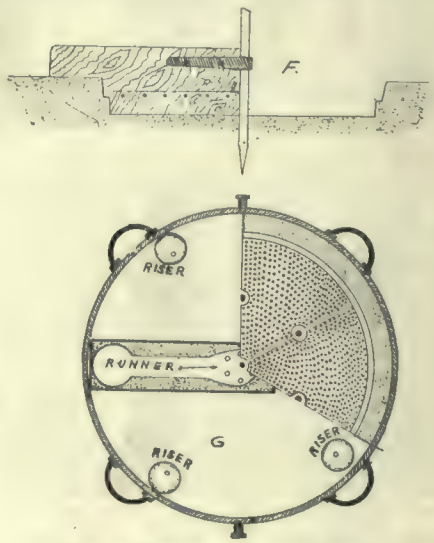



Fig. 4—Condenser Spray Plate.

show two of the section cores in position. the remainder showing the runners and risers. A small round gate on each of the six cross ribs spread the metal evenly and quickly, and minimized the risk of the small cores being washed away or broken through a flow of metal from any particular point. The weights were not removed from the mould till the following morning; this precaution keeping the casting quite straight, little chipping being required beyond the punching of the cores from the small holes. This operation was accomplished by a couple of men in a few hours.

## CONTEMPORARY CHANGES.

Owing to the fact that the demand on Mr. Henry M. Lane's services for professional assistance along engineering and metallurgical lines in foundry practice has become very great, he has ten-

dered his resignation as one of the editors of "Castings" and "Wood Craft," and will in the future devote his entire time and knowledge to expert consulting work in foundry practice. His long experience in solving problems in this line makes his well-known ability of great value to any foundryman who desires expert service. Announcement of Mr. Lane's successor will be made in due course.

## FLASKS FOR JAR RAMMING MOULDING MACHINES.

By J.F.G.

THE accompanying sketches illustrate a style of flask which is so constructed that it needs no bars to carry the sand, (E), and for this reason, there is not only much time saved in changing

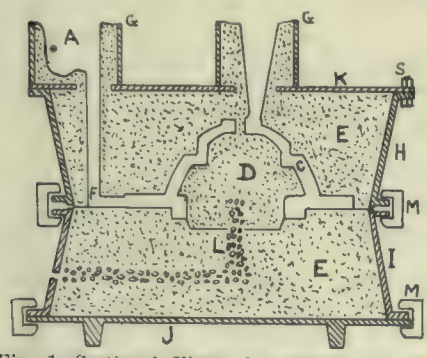



Fig. 1—Sectional View of Mould Ready for Pouring, Showing Mould, Core, Riser and Gate.

bars for different shaped patterns, but also the first cost of making these and their patterns. Now, as the flasks (H) and (I) are made tapered, so that the sand cannot slide out, we must have the top plate (K) to hold the sand when the cope is turned upside down to be finished, and also to keep the pressure of metal from pushing the sand up during the pouring operation. The top plate (K) will be the same as the bottom plate (J), except openings (R) and (Q) for gate (F) and riser (B); or as many holes as there are gates and risers required. It is also the best practice to cast holes in the top plate of the cope and oblong holes in the plate, as shown at (T). Further, it is safer, just as quick, and does not necessitate making the trunnions (N) as long as they would need to be if clamps (M) are used on the top part of the cope and bottom part of the drag. These flasks can be used up to a very large size on dry sand work, especially when the cope part of the mould is arch-shaped.

The ordinary iron boxes opened on two ends for building up runners and risers are indicated at (G), and (C) shows the cavity to be filled with molten metal. The core is shown in position inside the mould at D, and A represents the pouring basin.

## FIRE PROTECTION FOR FOUNDRIES.

AT the New England Foundrymen's Association meeting held in Hartford, Conn., on May 8th, a committee was appointed to look into better fire protection and insurance rates for foundry properties. The chairman is

Fig. 2—Sectional View of Drag Part of Pattern Attached to Board with Drag Part of Flask, Ready to Place on Jarring Machine.

Bartlett M. Shaw, of the Walker-Pratt Mfg. Co., and the other members are George P. Aborn, of the Blake & Knowles Steam Pump Co., and Henry A. Carpenter, of Providence, R.I. Both Mr. Shaw and Mr. Carpenter are past presidents of the association. It is the intention of this committee to study the whole subject of fire protection in foundries, with particular reference to improving conditions and thus securing better insurance rates. The main object, however, has actual saving of property back of it rather than a mere adjustment of rates, for it is realized that the true purpose of any such study is to lessen the destruction by fire of created properties.

## LET THE FOUNDRY ASSERT ITSELF.

MR. H. M. RAMP, superintendent of the Modern Foundry Co., in his address before the Superintendents' and Foremen's Club, Oakley, Cincinnati, Ohio, said that "while the foundry deserves much criticism and correction, it

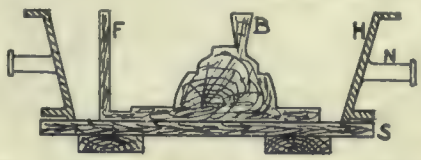



Fig. 3—Sectional View of Cope Part of Pattern Attached to Board with Cope Part of Flask Ready to Place on Jarring Machine.

has never had the attention, the brains, the research work, or the finances poured in upon it that the machine end of the iron industry has had to elevate and develop its possibilities. It has been considered more as a necessary evil than as a branch of the business that could be mastered, developed and controlled. The foundry, until the last few years, has been the last place to receive improvement and advice, and it is not as yet burdened with a load of either.

"The individual who entered the foundry as a life's business was always regarded as sinking his intellectual or mechanical abilities, if he had any. The foundry has been demeaned and often referred to as a place where the qualifications are 'a strong back and a weak mind,' and yet there is no business under the canopy of heaven that requires greater judgment and a more thorough knowledge of fundamental principles than the art of molding. When properly done it most certainly deserves to be classed as an art, and yet this is the atmosphere in which foundries were developed and foundrymen made until the past few years, while the machine shop was commanding the gray matter and finances of the brightest men, everywhere available.

This prejudice against the foundry in the past, as a place of dirt and grime fit only for occupation by hewers of wood and haulers of water, has done much to retard the development of the foundry business and to keep the bright, ambitious and energetic men from mastering its science.

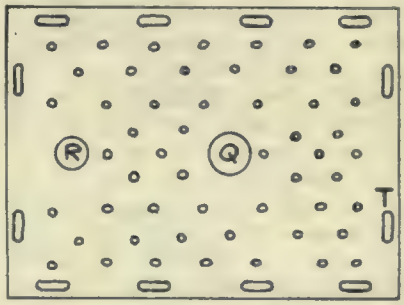



Fig. 4—Top Plate Showing Holes Through Which Riser and Gate Pass, and Oblong Holes for Fastening with Bolts to Flask.

These are not, however, the only reasons why the foundry fails to give the machine shop what it asks. When the machine shop seeks to improve its tools or methods, it does not put blacksmiths or candy makers on the job—it uses the best educated brains and experience in the machine business that money can buy; yet too often, the pattern, the very foundation of the foundry's work, is constructed as the designer, the pattern foreman or the engineer directs, without even consulting the experience and preference of the foundry, and in as great a measure as this prevails just as great is the handicap placed upon the foundry."

## THE PEASE FOUNDRY CO.

The new plant of the Pease Foundry Co., to be erected in Brampton, Ont., will comprise 11 buildings, all one storey except the office building, which will have two stories, giving an aggregate floor space of 137,000 square feet. The buildings include a foundry, warehouse, shipping room, blacksmith shop, machine shop, core room and ovens, rumbling room, pattern shop, pattern vault and dome, and tin shop for the manufacture of furnace casings.

# Trade Gossip.

**Mr. Alex. Gibb**, agent for Beardshaw's steels and drills, has removed his place of business from 13 St. John St., Montreal, to St. Nicholas Bldg.

**H. L. Peiler & Co.**, of Montreal, have opened a special department to deal with the question of combustion, forced draught, gas and oil engines. L. H. Bacque is engineer in charge of this work.

**Mr. Alfred Still**, an English engineer, and author of a number of standard works, has been appointed chief engineer at the mines and hydro-electric plant of the Algoma Steel Co., in the Michipicoten district of Canada.

**Reported Merger.**—It is reported that the Thomas Davidson Manufacturing Company, of Montreal, the Kemp Manufacturing Company, of Toronto, and the McClary Manufacturing Company, of London, are again in negotiation towards a consolidation of interests.

**Canadian Steel Foundries.**—The output of the Canadian Steel Foundries Co. will double present capacity by the middle of June, as on the 15th of that month its new $1,000,000 plant at Longue Pointe, Montreal, will start operations.

**Pratt & Letchworth Co.**—The resignation of C. W. Sherman, general manager of the Pratt & Letchworth Co., was accepted at the meeting of the board of directors of that company, held in Buffalo recently, and took effect June 1. Mr. Sherman retires to organize a company to operate a steel foundry at Hamilton, Ont.

**The Belgo-Canadian Steel Co., Ltd.**, with a capital of $550,000, was incorporated recently to manufacture steel and iron castings. The head office and foundry are to be in Montreal and will be in operation shortly. The officers of the new company are: President, Alphonse Baillot; vice-president, L. G. Beique; sec.-treas., F. A. Beique.

Messrs. Baillot and L. G. Beique are well known to the foundry trade, being directors of Baillot's Gas and Steel Machine Co., Ltd., which has recently manufactured the equipment for several large new foundries.

**The Foss & Hill Machinery Co.** have removed from 329 St. James St. to new premises at 344 St. James St., where they will have better facilities for carrying a stock of the lines they handle. This firm has recently taken the agency of the J. I. Case Co., of Racine, Wis., for road rollers and contractors' equipment.

**Plastics, Limited, of Toronto**, have appointed the General Supply Company of Canada, Ltd., Ottawa, sales agents in Manitoba, Alberta and Saskatchewan for "Bakelite" valve discs and pump valves. This business will be handled from the Winnipeg branch. "Bakelite" valve discs and pump valves are being widely recognized by the trade.

**The Magnolia Metal Co.** has issued new booklets in English, Spanish and Portugese, containing testimonials and tests describing the value and uses of Magnolia Anti-Friction Metal, and giving full directions for pouring. These books are intended for general distribution, and anyone can obtain copy by addressing the company.

**The Stahlschmidt Tool Co., of Canada, Ltd.**, has just been incorporated under Dominion charter. The officers are: President, E. F. Walter; sec-treas., R. Gnaedinger, and general manager, E. K. Watson. Mr. Watson is admitted to be among the most competent tool and hardware authorities in Canada. This company is a branch of a German house of the same name, situated at Cronenfeld, near Solinger. They will handle high speed steel, tool steel and small tools of all kinds.

**The Smart-Turner Machine Co., Ltd., Hamilton**, have recently booked the following orders:—Joseph Battle, Thorold, Ont., Duplex Pump; The Western Construction Co., Courtright, Ont., Duplex Pump; Corporation of Dauphin, Man., pump for waterworks extension; The Wolverton Milling Co., Wolverton, Ont., Rotary Force Pump; The National Land Fruit & Packing Co., New Toronto, Duplex Pump; H. Webster, Norwich, Ont., Triplex Power Pump; The Keewatin Lumber Co., Keewatin, Ont., Duplex Pump; The Niagara Navigation Co., Duplex Pump; R. M. Breckenridge, Burlington Junction, Triplex Power Pump; Geo. Frid & Son, Hamilton, Standard Duplex Pump.

**The J. W. Paxson Co., Philadelphia, Pa.**, have issued their Bulletin No. 26, which deals in a comprehensive way with the cupola, blower, cupola lining and cupola practice in general. Special reference is made to the Paxson-Collian cupola, as exclusively manufactured by this firm. These are built in sizes having capacities from ½ to 25 tons per hour, the former size being designed for the use of research laboratories, technical schools, etc. The company own quarries from which they are prepared to supply mica-schist in car load lots. This material is meeting with increasing favor for patching cupola linings; being as easily applied and lasting much longer than fire brick.

The bulletin contains many useful hints on the care, preparation and operation of cupolas, and will be gladly sent to parties interested.

**Harker & Kembley**, brass founders, brass finishers and general machinists, 81 Peter Street, Toronto, report a steady development and increase in their business up to May of this year; that month marking the completion of one year's establishment of the plant. We understand that steps are being taken to extend the shop, and opportunity will be taken to still further add to the tool and other equipment by the installation of the latest machinery available. Mr. Harker was for 24 years foreman of the brassfinishing department of Wilson & Cousins, Toronto, while Mr. Kembley has been foreman of the J. J. McLaughlin Co., brass finishing department, Toronto, and inspector with the Westinghouse Machine Co., Pittsburg.

**The Van Norman Machine Tool Co.** has been incorporated with a capital stock of $400,000, with the following officers: President, F. H. Page; treasurer, C. J. Wetsel; vice-president, C. E. Van Norman; secretary, F. D. Van Norman. Mr. Page is president of the National Equipment Co., builders of candy machinery, and Mr. Wetsel has been treasurer and general manager of the Baush Machine Tool Co. for the past eight years.

The Van Norman Machine Tool Co. will carry on the business formerly conducted by the Waltham Watch Tool Co., and will build the Van Norman line of "Duplex" milling machines, Universal bench lathes, "High Speed" grinding machines, etc., covered by patents of Charles E. Van Norman and of Fred D. Van Norman.

Charles E. Van Norman and Fred D. Van Norman are Canadians, being old Hamilton, Ont., boys, who started the tool manufacturing business in Springfield, Mass., known as the Waltham Watch Tool Co. The new Van Norman Machine Tool Co. is the outgrowth of this business.

**The Humber Machine Co.** — About three years ago the Humber Machine Co., Humber Bay, Toronto, took over the machine shop of Mr. W. J. Nesbitt, who, prior to that time, had been conducting a small machinery repairing business with a number of west-end manufacturing concerns. After a long up-hill struggle, in which were met many obstacles and reverses, they have succeeded in building up a live business in general machinery repairs, and the manufacture of trade specialties and special machinery to order, and it has now been found necessary to treble the amount of floor space in order to take care of increasing orders. Much of this highly satisfactory state of affairs is due to the fact that during the past six months the firm have gone into the manufacture of a special line of machinery to meet the demand of one of Canada's fast growing industries, and the success in this feature has enabled them to extend business connections across the entire Dominon.

# A WINNING HAND

THE Foundryman who uses **Stevens' Genuine East India Plumbago,** or **Ceylon Lead,** always plays a winning hand. He is betting on a sure thing.

I import this article direct from India, because it is absolutely the best plumbago produced in the workshop of Dame Nature.

It's use enables the foundry to do the work sometimes left for the machine shop to finish.

I manufacture everything used in a Foundry and in a Polishing and Electroplating Department.

In buying from me you are buying from first hands.

It costs as much to sell one thing as to sell them all. I sell them all for a small slice of profit. I take the small slice and give you the rest.

***Take Time to Write Me a Letter.***

## FREDERIC B. STEVENS, Manufacturer
## DETROIT, MICHIGAN

**BRANCHES:**

**INDIANAPOLIS, IND.**
142 East Georgia Street
Hoosier Supply Co.
Jos. M. Johnston, Manager

**WINDSOR, ONT.**
20 Pitt Street

**CHATTANOOGA, TENN.**
Dixie Foundry Supply Co.
O. L. Gard, Manager

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Sarnia, Ont.**—The municipal council have negotiations on with the management of a large steel manufactory. They have offered one acre of land free.

**Ottawa, Ont.**—It is reported that a new plant for the manufacture of wire cloth is to be built in Ottawa, Canada, by John R. Buchanan of the Appleton Wire Works of Appleton, Wis., manufacturers of the same line of goods. Mr. Buchanan has severed his connection with this company and is organizing for manufacturing in Canada.

**Calgary, Alta.**—Within a month or two, work will be started on the building of a railway to the property of the Alberta and Canadian Iron Syndicate, 25 miles west of Okotoks. When railway is completed, a smelter and 400 ton stamp mill will be erected. The whole project will involve an expenditure of $5,000,000. P. Burns is behind the venture.

**Port Mann, B.C.**—A car building and accessories plant is about to be established at Port Mann, B.C. The plant will include a cast steel foundry and rolling mill. It will cost $1,500,000 and will employ about 1,200 men.

**Sault Ste. Marie.**—It is announced that henceforth the Lake Superior Iron and Steel Company located at Sault Ste. Marie, Ont., will be known as the Algoma Steel Corporation Limited. The capital is increased from $1,000,000 to $30,000,000.

**St. Mary's, Ont.**—The Maxwell Machine Works at St. Mary's, Ont., are enlarging their plant by an additional storey to their carpenters' shop.

**Galt, Ont.**—The Malleable iron foundry located at Galt, Ont., will shortly add an extension. The new building will be 60 x 60 and will be of steel and brick.

**Port Colborne, Ont.**—The Buffalo Furnace Works recently executed with the Minister of Railways, a lease of a part of the reserve on Welland Canal at Port Colborne, Ont. The company plans to expend $210,000 in the development of its industry there.

**Victoria West, B.C.**—The Canadian Pacific Railway is calling tenders for constructing machine shops, roundhouses, turntables, and repair tracks at Victoria, West, B.C.

**Regina, Sask**—The Garden City Feeder Company, Limited, manufacturers of agricultural machinery is about to establish at Regina, Sask. The company is just starting up and is incorporated with a capital of $100,000.

**Fort William, Ont.**—It is reported that J. J. Hill and associates have purchased two miles of lake front near Fort William, Ont., as a site for steel works, foundry and blast furnace.

**Gravenhurst, Ont.**—Fred J. Brown, founder of the Northern Ontario Engineering Works at Cobalt, Ont., has started the erection of a machine shop for the repairing of gasoline. oil engines, etc.

**Belleville, Ont.**—The Marsh and Henthorn foundry company will have extensive and up-to-date buildings at Belleville, Ont. The machine shop, which will be the principal building, will be 142 x 65 feet; the boiler shop 122 x 36 feet; the blacksmith shop 60 x 35; and the pattern shop 40 x 60 feet. F. H. Herbert, of Toronto, is the architect.

### MUNICIPAL.

**Melford, Sask.**—The ratepayers are about to vote on two by-laws; one to raise $60,000 for waterworks construction and another to raise $30,000 for cost of sewerage construction.

**Collingwood, Ont.**—The people of Collingwood will soon have the opportunity of voting a bonus to the Canadian Vending Machine Company, about to commence operations there.

**Battleford, Sask.**—Among the many civic improvements taking place at Battleford, Sask., is the construction of the sewerage system and the waterworks, which involve an outlay of $100,000.

**Kelowna, B.C.**—The following by-law was recently passed by the ratepayers: $7,000 waterworks extension.

**Vernon, B.C.**—The following by-laws have received the sanction of the ratepayers:—$7,500 for municipal building; $40,000 for extension of waterworks system.

**St. Catharines, Ont.**—The burgesses sanctioned by-law, recently submitted, calling for a bonus of $4,000 to the Canadian Warren Axe and Tool Company.

**Prince Albert, Sask.**—The ratepayers ratified the following by-law:—To raise $73,800 for extensions of water mains.

**Delta, B.C.**—The ratepayers passed two by-laws, one to raise $15,000 for municipal building and another to raise $4,000 for purchase of road-making machinery.

**Oakville, Ont.**—The town council has decided to expend $20,000 on the Water and Light Commission.

**Moose Jaw, Sask.**—The burgesses passed the following by-law:—$60,000 for high pressure system.

**Moncton, N.B.**—The ratepayers may be called upon at any time to vote $3,600 for a motor truck.

**Fort Frances, Ont.**—The ratepayers recently ratified by-law to grant a bonus of $25,000 to the Fort Frances Power Company.

**Brandon, Man.**—The ratepayers passed the following by-laws:—$1,500 for street improvements; $12,000 for right-of-way for the Brandon Transfer Railway; $33,000 re new firehall; and $100,000 re cost of improvement of the waterworks system.

**Merritt, B.C.**—The property owners ratified the following by-laws:—To raise $40,000 for erection of pumping station; $20,000 re installation of electric light plant; $10,000 for building of sidewalks and $3,000 re purchase of site for a public school.

**St. Thomas, Ont.**—The board of trade has decided on the expenditure of $4,000 re encouragement of new industries.

**Duck Lake, Sask.**—The by-laws aggregating several thousand dollars were passed by burgesses. The by-laws involved an expenditure of $4,000 for flour mill and $6,000 for new town hall.

**Port Dalhousie, Ont.**—The burgesses voted in favor of by-law to raise $10,000 re the cost of repairing the electric lighting system.

**North Vancouver, B.C.**—The North Vancouver Gas and Coke Company are about to start construction of their works at North Vancouver, B.C. They request certain concessions from the city, and are awaiting the sanction of the by-law, placed before the ratepayers, granting same. The company is incorporated under the above title, with subscribed capital of $200,000.

**South Vancouver, B.C.**—The local board of works has ordered road improvements on an elaborate scale, involving an expenditure of $132,967, also the purchase of steam shovels, etc.

### ELECTRICAL.

**Orangeville, Ont**—The Dufferin Light and Power Company's property at Orangeville, Ont., has been sold to J. M. Milburn, of Owen Sound, for $46,000.

**Hydro-Electric Power Co.**—Five more towns in the northern part of Ontario will be served by the Hydro-Electric Power Co., viz.: Barrie, Staynor, Collingwood, Coldwater and Elmvale.

**Saskatoon, Sask.**—H. M. E. Evans, of the Saskatoon Power Company, reported to the council that 14,000 h.p. could be generated at total cost of $2,200,000, and the council are considering the situation.

**Sturgeon Falls, Ont.**—The Nipissing Electrical Repair Company has recently been established at Sturgeon Falls, Ont. H. J. Hopes is in charge.

**Caledonia, Sask.**—The village council are about to secure the installation of the Hydro-Electric power system.

**Melford, Sask.**—The burgesses of Melford, Sask., are about to vote on a by-law to raise $35,000 for the installation of an electric light plant.

**Niagara Falls.**—The City Council has received permission from the Ontario Government and the Hydro-electric Power Commission to proceed with the construction of a new power house and pumping station, which, from an engineering point of view, will be a unique and interesting project. The plant will be located on the Canadian side of the upper river, several hundred feet from the crest of the Falls, in a chamber excavated out of solid rock and at the bottom of a shaft 125 feet deep on a level with the lower river. The object is to remove the existing power house and pumping station near Table Rock, which is not only unsightly to tourists, but is also inefficient and inadequate. It is now being used to pump water for the city, and the latter is buying power for lighting purposes from a private company. The existing plant was frequently choked by ice in winter, and was found incapable of maintaining a normal service either of water or power. With the new 1,500 horse-power plant the city will get an uninterrupted supply of both, and will be in a position to furnish power both for street lighting, pumping and for factories. The principal factors in the scheme are a 120-foot penstock, eight feet in diameter. The water will be carried down through this long tube, which will be of steel construction, into the turbines. Ice and surplus water will be diverted through an underground channel into the lower river, thus eliminating trouble from frazil ice. Before going ahead with the work the Council will have to secure permission from the Queen Victoria Niagara Falls Parks Commission, who, it is believed, will readily consent to the proposition. The members of the Council were in Toronto recently, conferring with the Ontario Government.

### GENERAL MANUFACTURING.

**Portage la Prairie, Man.**—The Stephens Brick Company has completed arrangements for the erection of another brickyard. The new plant will have a capacity of 50,000 bricks per day.

**Guelph, Ont.**—Messrs. Grant & Armstrong have secured the sole agency for the Royal Spring & Bedding Co., in Canada and plans are about completed whereby they will commence at once to manufacture the Ingle patent bed spring and bedding line.

**Calgary, Alta.**—A carriage factory is about to be established in East Calgary by J. Wetmore and Company. The shop promises to be the largest west of Winnipeg and at the start will employ 25 men.

**Winnipeg, Man.**—Three buildings owned by Tees and Persse and used for storing stoves and furnace of the Waldon Company were recently destroyed by fire. The damage done amounted to $45,000; two-thirds of which is covered by insurance.

**Calgary, Alta.**—A new clay producing plant is about to be established, to be known as the Tregillus Clay Products Company. It will be a close corporation with a capital investment of $500,000; and will employ 200 skilled hands, although it is expected that ultimately as many as 500 men will be employed. W. J. Tregillus is behind the movement.

**Medicine Hat, Alta.**—An agreement has been reached through Mayor Spencer whereby Dr. Wright of Spokane, Wash., is about to locate a factory in the city for the purpose of manufacturing chalk. The capitalization is placed at $25,000 and the plant will employ 25 men; later to be increased to 100.

**Stratford, Ont**—Fire gutted the factory of the Tolton Manufacturing Co. recently. The roof was destroyed and the furniture and machinery damaged by water. The loss is fully covered by insurance, and the cause of the fire was an overheated stove.

**Camrose, Alta.**—The tannery owned by Francois Adam has been burned down. The total loss is about $25,000 which is partly covered by insurance.

**Moose Jaw, Alta.**—It is reported that the Federal incorporation of the Canada Flat Fibre Company, Limited, is about to start operations in the prairie provinces for the manufacture of paper.

**Toronto, Ont.**—The bed factory of the Anchor Manufacturing Company was partly destroyed by fire a short time ago. The loss caused is about $20,000 which is fully covered by insurance. It is understood that a new factory will shortly be erected by the company to cost about $35,000.

**Espanola, Ont.**—The Spanish River Pulp & Paper Company have started operation here with two machines. Both have a capacity of 100 tons of newspaper material and 170 tons of pulp material daily. Provision has been made so that the mill capacity can be readily doubled at minimum capital expenditure.

**Crabtree Mills, Que.**—The paper mills of Edwin Crabtree & Sons, Limited, have been completely destroyed by fire. The damage, amounting to from $65,000 to $70,000, was fully covered by insurance. The company are making arrangements to construct new mills at once.

**Walkerton, Ont.**—A biscuit factory is about to be established here. It, at first, will employ from 8 to 10 men, and will be ready to start at an early date. Robert Smith and John McCartney are behind the venture.

**Stratford, Ont.**—Danford Elk Shoe Company, Limited, of Windsor, Ont., have purchased a factory on William Street and will

commence at once the manufacturing of elk shoe leather. The promoters are: D. M. Ferguson, Robert McEwen, J. A. Davison, C. S. Macpherson and W. C. Dunford.

**Toronto, Ont.**—The Keens Manufacturing Company, makers of whitewear, are about to erect a factory on Spadina Avenue.

**Danville, Que.**—The factory of the Dominion Novelty Company was burned to the ground recently. Damage was done to the extent of $25.000. Spontaneous combustion is the theory offered as likely cause.

**St. John, N.B.**—It is now definitely understood the Gibson timber land and property will be taken over by the syndicate of American capitalists of whom Senator Jones is leader. The new company will manufacture pulp and paper.

**Transcona, Man.**—Operation of the Dominion Tar & Chemical Company's works at Transcona, Man., are about to commence. The works will employ about 100 men; to be increased to 150 in a short time.

**Brantford, Ont.**—A fierce fire which caused damage to the extent of $65,000 broke out at the Farmers' Binder Twine Factory recently. It is supposed to have been caused by lightning. The loss is mostly covered by insurance.

**Guelph, Ont**—Tenders are being called for the erection of a three storey warehouse by the Guelph Carpet Mills Company at Guelph, Ont.

**Toronto, Ont.**—The establishment of a hundred-ton capacity pulp mill at a cost of about $500.000 and the erection of a hundred-ton paper mill at the direction of the Government is about to take place at Toronto, Ont. Tenders are invited for same.

**Brandon, Man.**—Fire recently destroyed the Maple Leaf Milling Company's elevators at Brandon, Man. The total loss, which is covered by insurance, is estimated at $60,000.

**Wetaskiwin, Alta.**—The Vulcan corporation is about to erect an automobile factory at Wetaskiwin, Alta. It will cost about $1,500,000 and will be the largest enterprise of its kind in Canada.

**Seaforth, Ont.**—W. J. Duncan, legging manufacturer has notified the local board of trade that, on account of his present quarters being too small for his increasing business, he would move to Stratford or London unless he received grant of a suitable building. The board recommended the purchase of the Grip Hotel property, to be paid for by Mr. Duncan in fifteen annual instalments.

**Fort Frances, Ont.**—An agreement has been reached between the town and the Minnesota and Ontario Power Company whereby the company agrees to build a 100 ton pulp and paper mill and to operate same.

**Greenwood, B.C.**—A cannery and fertilizing plant to cost $300,000 will be built on the opposite shore of Tuck's Inlet; work to begin as soon as site and plans are prepared.

**Guelph, Ont.**—At a recent meeting of the Board of Directors of the Dominion Co., a new industry starting up, it was decided to to call for contracts for the new building as soon as specifications have been drawn up.

**Cobourg, Ont.**—Martin Jet and Company of this place, have secured the contract for the new factory for the British-Canadian Canners at $35,000 exclusive of machinery, etc.

**Guelph, Ont.**—The Colonial Knitting Company, Limited, has started operations and promises to be a great asset to the city of Guelph.

**Berlin, Ont.**—President S. Nordheimer, of the Foster-Armstrong Piano Co., submitted a proposition to the town which will be taken up by Indusfrial Committee. The substance of the proposition is that if the company can get a $1,500 loan from the town they will in turn erect a 200 by 60 feet building and employ 70 hands.

**London, Ont.**—T. Dexter and Son will abandon their mill on the Thames and construct a mill in East London to be operated by Niagara power.

**Calgary, Alta.**—The Industrial and Development Bureau of Calgary, announce that Craig & Rose, Limited, of Edinburgh, Glasgow and London have decided to locate their Canadian branch here. This is one of Great Britain's largest print manufacturing firms.

**Parry Sound, Ont.**—A new industry has been started up within the past few weeks, and promises to be of some importance. The industry is known as The Flempol Manufacturing Company, Limited, and is capitalized at $100,000. Furniture polish will be manufactured.

**Warwick, Que.**—The Dominion Comb and Novelty Company's factory was burned lately and sustained a loss of $30,000. Insurance was $12,000.

**Glassy Lake, Alta.**—Fire totally destroyed the 30,000 bushel elevator of the Medicine Hat Milling Co. $18,000 is the estimated loss, partly covered by insurance.

**Niagara Falls, Ont.**—The burgesses have recently passed a by-law authorizing a grant

**Good Tool Grinding**

**A Machine Shop Necessity.**

**Our Line**
**12", 16", 20", 24"**
**Machines**

**Belt or Motor Driven.**

Also
**FLOOR GRINDERS**
**12 to 36" Wheels.**

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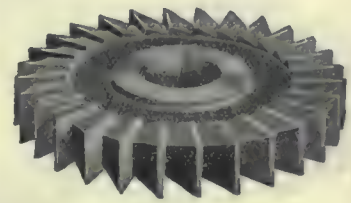
HAMILTON, ONTARIO

Our 25-lb.
**Power Hammer**
is well made in every particular. Ask us for price.

Canadian Giant No. 25.

**A. B. JARDINE & CO.**
**HESPELER, ONT.**



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Will increase the efficiency of your men and your machine.

Will give the longest and most satisfactory service.

They are made from the highest stock by the most approved methods and are fully guaranteed. A trial will convince.

WRITE FOR CATALOG B.

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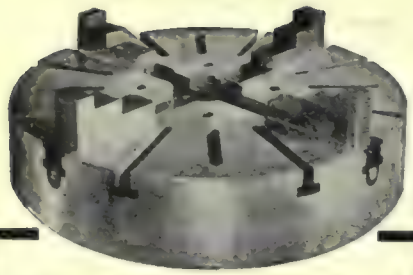
Cleveland
Sixth City



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We maintain that *no* test is too severe for the

**IMPERIAL CHUCK**

and we know you will agree with us, once you have tried it.

May we send you one, carriage paid, on 30 days' FREE TRIAL? Use it in your shop, test it any way you can think, and if it won't do all you ask of it, and more, send it back *at our expense.*

Let us have your request for a FREE TRIAL of the "Imperial." Write us to-day.

Send for catalogue.

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Brantford, Canada

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Mfrs. of **SPECIAL MACHINERY**
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GEAR CUTTING, TOOLS, DIES, ETC.
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**RAILS** and **SUPPLIES**
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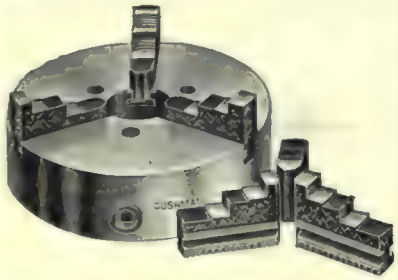

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are generally known as the "heavy pattern" being designed for hard service.

Their accuracy and reliability have been proven over and over again and the name "Cushman" on your chuck is a guarantee of satisfaction.

Our line consists of many styles and sizes of Lathe Chucks, Drill Chucks, Centering Chucks and Face-Plate Jaws.

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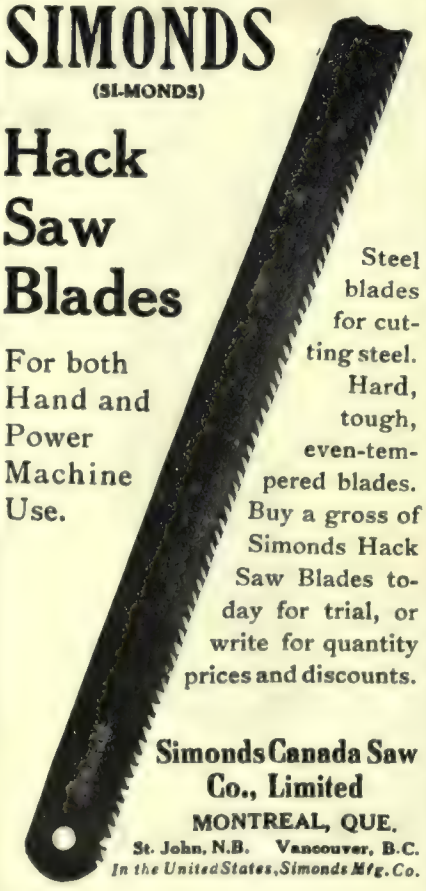
**The Cushman Chuck Co.**
Hartford, Conn., U.S.A.
Established 1862

**SIMONDS**
(SI-MONDS)

**Hack Saw Blades**

For both Hand and Power Machine Use.



Steel blades for cutting steel. Hard, tough, even-tempered blades. Buy a gross of Simonds Hack Saw Blades today for trial, or write for quantity prices and discounts.

**Simonds Canada Saw Co., Limited**
MONTREAL, QUE.
St. John, N.B. Vancouver, B.C.
*In the United States, Simonds Mfg. Co.*


of $3,000 to E. T. Pollard for a site for his new industry.

**Blyth, Ont.**—The ratepayers recently ratified a by-law to grant a loan of $5,000 to the Blyth Flax Mill Company.

**Medicine Hat, Sask.**—Two by-laws are about to be brought before the people. Both are to raise money for industrial sites.

**Fort William, Ont.**—The "Arena" Rink, one of the largest in Ontario, was burned to the ground quite recently. The loss is placed between $30,000 and $35,000; covered by insurance.

### PLANING MILLS AND SAW MILLS.

**Galt, Ont.**—What is known as the old Scott planing mill, at Galt, owned by W. R. Osborne, has been sold to H. F. Bailey who will completely overhaul the building and machinery.

**Pelican, Ont**—It is reported that the Carthy sawmill at Pelican, Ont., has been completely destroyed by fire. No details are given.

**Revelstoke, B.C.**—Operations at the Dominion sawmills of Taft, Three Valley and Comaplix will begin at once. The mills will employ about six hundred men.

**West Toronto, Ont.**—The planing mill of Gibson, McCormack & Irving was swept by fire a few days ago. The damage amounted to $2,800.

**Battleford, Sask.**—The Battleford Overland Manufacturing Company propose erecting a two-storey factory 40 x 100 feet to be equipped with machinery capable of turning out all kinds of finished wood work. They are asking certain concessions from the town.

**Victoria, B. C.**—Damage to the extent of $80,000 was done by a fire which recently broke out in the plant of the Canadian-Puget Sound Lumber Company at Victoria, B.C. The chief loss to the company will be the destruction of the up-to-date machinery which was only recently installed.

**Winnipeg, Man.**—The lumber mills of Brown & Rutherford were completely destroyed by fire involving a loss of $200,000, of which, only $16,500 is covered by insurance.

**North Vancouver, B.C.**—Fire recently destroyed the saw and shingle mill of the Seymour Lumber Company of North Vancouver, B.C.. The total loss was approximately $50,000.

**Owen Sound, Ont.**—The saw mill of the Carney Lumber Company was wiped out by fire recently and entailed a loss of $150,000, only partly covered by insurance.

**Nelson, B.C.**—It is reported that the Cascade mill of the Dominion Sawmills, Limited, of Nelson, B.C., will, this year, increase their output by six million feet over last year's output. This will make twenty million feet.

**Fort Frances, Ont.**—A large, new woodworking factory is about to commence operation here. The plant will be operated by electric power and will be modern in every respect Messrs. Schroeffer and Johnson are behind the movement.

### BUILDING NOTES.

**Treherne, Man.**—The Municipality of South Norfolk is asking tenders for a municipal building of solid brick, 22 x 36 feet, the cost to be about $2,500.

**Edmonton, Alta.**—Work has been commenced on a $100,000 banking office here.

**Winnipeg, Man.**—St. John's College has let to Worsick Brothers the contract for the erection of a new college at a cost of $40,000.

**Moose Jaw, Sask.**—The Western Building Company have been awarded the contract to build the Edward schools for $30,972.

**Toronto, Ont.**—The Methodist Book-Room have decided to erect a new ten-storey building on the site of the present book room on West Richmond Street. This will cost in the neighborhood of $200,000.

**Winnipeg, Man.**—The contract for the bridge at St. Andrews locks has been awarded to the Brown Construction Co., Limited, of Winnipeg. The contract price is approximately $150,000.

**Edmonton, Alta.**—C. W. Sharp & Son recently signed the contract for the new Canadian Pacific building here to cost $350,000. Work will commence at once.

**St. Catharines, Ont.**—A six-storey building will be erected by J. Birchenough soon. The price paid for site was $750,000. No details are given.

**Quebec City**—A new immigration building is now under construction. The building will be 800 feet long by 85 feet wide, of two storeys and reinforced concrete construction. It will cost $350,000. C. E. Deacon & Company, of Montreal, are the contractors.

**Victoria, B.C.**—The Westholme Lumber Co. is constructing a 7-storey $100,000 block for Hibben-Bone Co., and also the new St. James Hotel.

**The Canadian Department of Public Works** has advertised for tenders for the construction of the Quebec Dry Dock. Tenders will be received up till July 2nd. The dry dock is to be not less than 1,150 feet in length, 110

# A Universal Grinding Machine of Low Price

**that has usurped the field hitherto held by only very expensive tools, is made by**

# DRUMMOND BROS., Limited,

**REID HILL GUILDFORD ENGLAND**

**CANADIAN AGENTS:**

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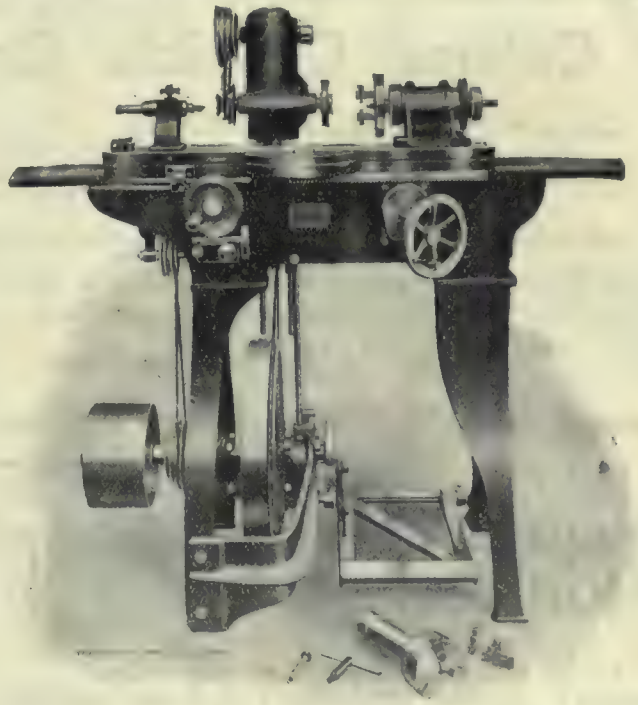
The tool, illustrated here, will do

**Cutter Grinding**
**Flat Grinding**
**Parallel Grinding**
**Taper Grinding**
**Outside Grinding**
**Internal Grinding**

in fact, all the work that the most expensive Universal Grinding Machines will do, so easily that it can be driven by foot power.



## Price $228 at Works in England

This Machine has ball bearings throughout, including the fly wheel, and is of the finest workmanship, material and accuracy. It is supplied so that foot or motor power can be used, as desired.

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|---|---|
| **Length over all** | **6 ft. 3 1/2 in.** |
| **Length between centers** | **1 ft. 5 in.** |
| **Center height over table** | **3 1/2 in.** |
| **Transverse of table** | **1 ft. 5 1/2 in.** |
| **Angular movement of table** | **45°** |
| **Cross trasverse of grinding head** | **5 ft.** |
| **Rise and fall of grinding head** | **6 in.** |

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**Do Your Tumbling**

in a Globe improved Tilting Tumbler and get finest results, quickest and cheapest. It is made in six sizes for all purposes for wet or dry work.

**"GLOBE"**

Dies and Stampings.

Special Manufacturing Contract Work.

If you want to get an interesting little magazine free, ask for "THE SILENT PARTNER."

**THE GLOBE MACHINE & STAMPING CO.**

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**Cutting Crucible Costs**

Cost and price are distinct terms.

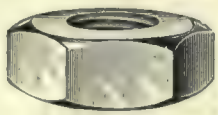
DIXON'S CRUCIBLES

are less costly because of the service you get out of them. They give more heats and more general satisfaction than you usually get from crucibles.

WRITE FOR BOOKLET *No. 223-A.*

**Joseph Dixon Crucible Co. - Jersey City, N.J.**

**"MORROW" SCREWS**
**"MORROW" NUTS**



You may possibly think that other makes might answer, but there is no reason why you should not have the best. The best are Morrow's. Morrow Screws and Nuts are the Canadian Standard. Insist on getting them from your dealer, also get a number 8 Catalogue if you have not already got one.

**John Morrow Screw and Nut Co., Limited, Ingersoll**

BEST LEATHER BELT MADE

THE J.C. McLAREN BELTING Co. OAK TANNED EXTRA EST 1856

TORONTO MONTREAL WINNIPEG

ST. JOHN, N.B. VANCOUVER

feet clear width at entrance, and at least 37 feet in depth over sill and keel blocks. It is to be completed within four years from date of agreement.

**Toronto, Ont.**—A new hotel will shortly be built on King Street west, to be known as the new Woodbine Hotel. T. H. Herbert is the architect of the building which will cost about $150,000.

**Galt, Ont.**—Messrs. Thomas and Hancock, of Galt, has secured the contract for the new Bank of Toronto office here. This firm has sublet the contracts for the different trades in connection with the construction of the building.

**Vancouver, B. C.**—A first-class opera house is about to be started here. Its seating capacity will be about 1,550 and will cost approximately $600,000. The building, which will be five stories high, will be of steel-frame construction.

**Saskatoon, Sask**—The Canadian Pacific Railway has purchased fifty feet of land as site for a proposed modernly equipped office building to cost about $200,000.

**Moose Jaw, Alta.**—It is reported that W. B. Sherman of Calgary, is about to erect a theatre capable of seating 1,200 to cost about $100,000.

**Saskatoon, Sask.**—A large Winnipeg building firm has purchased a site on 20th street west and will commence at once the building of a seven storey apartment block.

**Athabasca Landing, Sask.**—What will be the first pulp mill west of Sault Ste. Marie, Ont., is shortly to be built here. Plans are not yet furnished.

**Valley Railway, N. B.**—The following firms been awarded contracts for the Valley Railway:—James H. Corbett & Sons, from Rothesay to Fredericton, 66 miles; Quebec Contracting Company from Fredericton to Woodstock, 61.5 miles; Kennedy & McDonald, Woodstock to Centreville, 25 miles.

**Western Canada.**—Among a number of buildings to be erected in Western Canada in the near future are the Winnipeg drill hall to cost $100,000; Calgary post office to cost $200,000, and a warehouse to cost $100,000, also at Calgary, Alta.

**Winnipeg, Man.**—Plans are in preparation in the office of Ross & McFarlane, architects for a 12 storey office building. The price paid for the property was $3,450 per foot or $172,500 in all.

**Port Arthur, Ont.**—Within a month it is expected that three storey steel building will be erected to cost $70,000. Messrs. Laird and Peacock of Regina, are behind the venture.

**Transcona, Man.**—The C. P. R. recently awarded a contract to Barnett & McQueen for a million bushel transfer elevator with all modern appliances. Work will begin at once.

**Winnipeg, Man.**—A Fort Street property was recently sold to an English syndicate for $100,000 and upon this property a block of offices are to be erected to cost $1,000,000.

### RAILROAD ORDERS PLACED.

**Montreal, P.Q**—A report states that the management of the Grand Trunk Railway have recently placed freight car orders as follows:—1,000 box cars with the Western Steel Car and Foundry Company, of Chicago; 2,000 box cars with the Canadian Car and Foundry Co., of Montreal; 250 auto cars with the American Car and Foundry Co., of Detroit; 250 auto cars with the Western Steel Car and Foundry Co., of Chicago; 250 refrigerator cars with the Canadian Car and Foundry Co., of Montreal; 1,000 new steel hopper bottom coal cars with the Pressed Steel Car Co., of Pittsburg.

**Montreal, P.Q**—A report states that the Canadian Pacific Railway Co. has ordered 250 new engines and 12,500 box cars. It is altogether likely this is the largest amount of rolling stock ever placed on order at one time in this country.

### CATALOGUES RECEIVED.

**The Railway Asbestos Packing Co., Ltd., Sherbrooke, Que.,** have sent us a couple of booklets explaining the properties and advantages of the new Asbestos Lubricants lately produced by them. These lubricants are known by the trade names Journolene, Asbestolene and Spedolene. Journolene is especially intended for lubricating the journals of railway cars, street cars, pulp and paper mill machinery, etc. It consists of an amalgamation of asbestos with certain high-grade oils into a lubricating substance that cannot, it is claimed, be disintegrated by wear, and improves with age. It is offered as a decided improvement over wool-waste and oil as a packing for journal boxes, from the viewpoint of both price and efficiency. Asbestolene is intended for the lubrication of all kinds of heavy gearing, while Spedolene is designed for automobile use.

**The Fosdick Machine Tool Co., Cincinnati, Ohio,** has issued new circulars, showing their 4 ft. and 5 ft. National or simple type Radial Drills. These machines are their latest style, and have all the up-to-date improvements.

**Federal Engineering and Supplies, Ltd., Toronto and Montreal,** have issued a booklet showing examples of drives where Scandinavia belting can be used to advantage, both for transmission and conveyor purposes. Scandinavia belting is made of best grade long fibre cotton, and after being spun tightly into yarn, is very closely woven. It is then stretched and filled with a bituminous filling to make it as nearly waterproof as possible, and is then rolled between heavy rollers. This process results in a very strong, durable belt of uniform texture.

**Darling Bros., Ltd., Montreal,** the well known heating specialists, have forwarded a copy of their new book dealing with the Webster vacuum system of steam heating for factories, hotels, offices and public buildings. The book contains 80 pages and treats the subject very fully. Numerous explanatory diagrams are given, together with some excellent half-tones of many important buildings throughout the Dominion that are heated on this system.

**The Watson-Stillman Co., New York,** have issued their catalogue No. 85, which illustrates and describes the company's patented hydro-pneumatic wheel presses for belt or motor-drive. The hydro-pneumatic action of the ram, combining the certainty of hydraulic power with the quicker action of pneumatic tools, greatly increases the capacity of the machine. Air pressure from the shop system is used.

Another catalogue (No. 83), issued by the same firm, deals with hydraulic benders for rails, channels, tees, etc. These may be hand-operated, belt or motor-driven.

**The New Process Twist Drill Co., Taunton, Mass.,** have brought out a new catalogue and price list of their carbon and high-speed twist drills. These are made by a hot-forging process from round stock. The round bar is forged to the correct profile and then twisted while hot. Clearance is milled on them and they are then sand-blasted and ground to size. The company has been making drills for the past 25 years, and all their work is guaranteed against defects of material and workmanship. A new line now being introduced is the "Reliance" high-speed drill, which is made from profile stock and inserted in a carbon steel shank by a patented process.

**Baker Bros., Toledo, Ohio,** have favored us with copies of the catalogues Nos. 7B and 10, which set forth the merits of their fine line of drilling, boring and tapping machines, and of their well-known keyseating machines respectively. Parties interested are invited to write for copies.

**The Skinner Chuck Co., New Britain, Conn.,** have just issued their new catalogue and price list for 1912. Two additions have been made to the firm's well-known lines of lathe, drill and planer chucks. These additions consist of an all-steel independent lathe chuck and all-steel face plate jaws. Both lines are intended for the heaviest class of work in railroad shops, government works, etc.

**The Scully Steel & Iron Co., Chicago,** have mailed us a copy of the Scully "Blue Book" for 1912. This forms the firm's catalogue of Iron, Steel, Machinery, Heavy Hardware, etc., and also contains many valuable reference tables.

**William Steele and Sons Co., Toronto, Ont.,** have forwarded us a copy of a prospectus issued by them dealing with the various merits of Reinforced Concrete and Steel Construction, with special regard to industrial buildings. Several excellent views of completed structures and those in the course of erection are shown.

**"Hydraulic Benders"** is the title of a new and interesting 64 page 6 in. by 9 in. catalog devoted exclusively to hydraulic machines just published by the Watson-Stillman Co., 50 Church St., New York. Hydraulic benders are now commonly used for bending all kinds of rails, structural shapes, reinforcing rods, and pipe; for shaping automobile frames; for straightening rods or shafts while held between lathe centres, and in almost every other conceivable place where heavy bending is to be done. Free copy will be mailed to interested parties requesting Catalog No. 83.

**The Watson-Stillman Co., Hydraulic Engineers, 50 Church St., New York City,** have developed a filling liquid for hydraulic tools such as jacks, presses, punches, benders, etc., that does not freeze, thicken, gum or change chemical composition; and is invariably protective to the metal surface and packings with which it comes in contact. This liquid, called Jackohol, is described in a newly issued folder, Bulletin J, which will be sent to anyone interested.


**PATTERNS**
Patterns of Every Description.
Satisfaction Guaranteed.
**R. POTTS, Toronto**
85 Richmond St. W. Phone: Adelaide 103

**Laffitte** WELDING PLATES
**WELD AT A LOW HEAT**
save you time, fuel and labor.
SAMPLES free on request.
The Phillips-Laffitte Co., Penna. Bldg., Phila., Pa., U.S.A.

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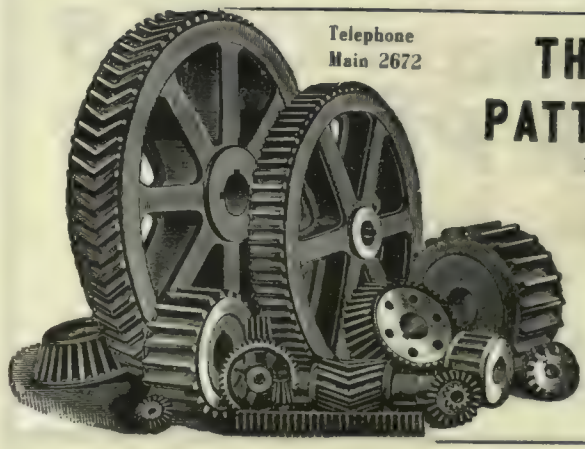
329 ST. JAMES STREET, MONTREAL
Sole Agents for
Schumacher & Boye, Lathes; The G. A. Gray Co., Planers; The Cincinnati Lathe & Tool Co., 16" lathes; The Mueller Machine Tool Co., Radial Drills; Hoefer Machine Tool Co., Drill Presses; The Queen City Machine Tool Co., Shapers; Racine Tool & Machine Co., High-speed Metal Cutting Machine; London Concrete Machinery Co., Concrete Mixers, Moulds, etc.; Detroit Twist Drill Co., Drills.
Wood and Iron Working Machinery, Pipe Threading Machines, Stone Crushers, Hangers, Shafting, Pulleys, Belting, Hack Saws, Canadian Hart Corundum Wheels in stock. The Dominion Metal Co.'s Babbitt.

**MAPLE LEAF**
STITCHED COTTON DUCK
**BELTING**
DOMINION BELTING CO. LTD.
HAMILTON CANADA

**PATTERNS AND MODELS**
**PATTERNS IN WOOD**
ALL KINDS
Difficult Core Work a Specialty
High Grade - Right Prices - Prompt Delivery
SATISFACTORY WORK GUARANTEED
THE HAMILTON PATTERN WORKS
258 CATHERINE STREET NORTH
HAMILTON, ONT.

**PATTERNS**
FOR
ALL KINDS OF MACHINE WORK MADE IN
WOOD, BRASS
WHITE METAL OR IRON
by the very highest class of skilled mechanics.
Only the highest grade of material used in our work. We can handle your pattern work to your complete satisfaction.
Let us quote prices.
TORONTO PATTERN WORKS
87 Jarvis St. Toronto, Canada

**CLEVELAND**
**Oil Tempered Steel Springs**
—for every purpose and the best for each use.
Special styles of all kinds to order.
THE CLEVELAND WIRE SPRING CO.
Cleveland, Ohio.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All classes of patterns in wood or metal.
Our work is good, our prices are right.
HAVE US MAKE YOUR PATTERNS

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145 Bleury St. MONTREAL
*Machinist and Tool Maker*
Dies for Sheet Metal Work.
Stampings and Light Manufacturing
Special Machinery Designed and Made to Order.

**Nickelplating**
AND
**Polishing**
Canadian Oliver Typewriter Company
275 St. Martin Street, Montreal
Phone—Uptown 1878.
*Special Machinery and Models Made to Order.*

BRONZE-ALUMINIUM-BRASS-MANGANESE BRONZE
**CASTINGS**
Why pay for bad castings and the machining cost on them? Our castings are right, and scientifically made.
**Lumen Bearing Company**
WESTON ROAD and C.P.R. - TORONTO, ONT.

**Jessop's Best Tool Steel** is yet unexcelled for cutting tools of all kinds, and for general machine-shop use.

**Jessop's "Ark" High-speed Steel** gives marvellous results—heavy cuts—at rapid speed; cannot be burned.

The favorite brands with users of good steel.
A large assortment of sizes in stock.
Jessop's high-grade files and rasps.

Manufactured by **WM. JESSOP & SONS, Ltd.** Sheffield, Eng.

Reid Newfoundland Co., St. John's, Newfoundland
Alex. Woods, 138 Murray Street, Montreal, Que
Chas. L. Bailey, 80 Bay St., Toronto, Ont

**DIES AND TOOLS**
**POWER PRESSES**
For Rapid Production of Sheet Metal Stampings
***W. H. BANFIELD & SONS***
***TORONTO, ONT.***

**The Ruggles-Coles Engineering Co.** have sent us a copy of their catalogue on rotary dryers; also their catalogues on the uses of Monel Metal. This metal takes polish like silver and retains it indefinitely. It is also non-corrosive. Copies will be sent on request to the sole Canadian agent, J. L. Danziger, 704 Eastern Townships Bank Building, Montreal.

**The Morse Twist Drill & Machine Co., New Bedford, Mass.**, have sent us a copy of their 1912 catalogue. It is got up on similar lines to previous catalogues issued by this old established firm, but is more complete; a number of new tools being illustrated.

**The Watson-Stillman Company, 50 Church St., New York,** has just issued Catalog No. 85 Hydro-Pneumatic Wheel Presses. This catalog describes and lists their line of full hydro-pneumatic wheel presses and those with hydro-pneumatic pull-back only. Seventy-six types and sizes, on which the Watson-Stillman Co. have exclusive patents, are listed. A copy will be sent free upon request.

**The John Morrow Screw & Nut Co., Ltd., Ingersoll, Ont.**, have issued a revised catalogue which illustrates by high-class cuts some of the leading standard and special lines manufactured by this well-known firm. These include standard and special screws of all kinds and special milled work in iron, steel or brass. The company manufactures hollow set screws in large quantities, while the Morrow cold punched nuts are too well known to need more than passing mention. Some interesting views are given of the interiors of the firm's offices and shops at Ingersoll.

**The C. A. Dunham Co., Ltd., Toronto, Ont.**, have forwarded a copy of their latest booklet illustrating the Dunham vacuo-vapor system of steam heating. This is a low pressure two-pipe vacuum system operating automatically without the use of a vacuum pump. The method employed is very simple and is fully explained in the booklet.

**The Lumen Bearing Co., Buffalo and Toronto,** have favored us with a copy of a booklet recently issued by them to show their facilities for making all kinds of non-ferrous castings and ingots. Excellent views of the Buffalo plant are given, while the whole booklet is attractively gotten up.

**The W. S. Rockwell Co., 50 Church St., New York,** have issued catalogue No. 14, illustrating various representative installations of Rockwell oil furnaces for annealing, hardening, carbonizing, brass melting, etc., etc.

**The Adams Co., Dubuque, Iowa,** send us a copy of their circular No. 812, which describes and illustrates the special features of the No. 4 Farwell Universal Gear Hobber. This machine will cut spur, spiral and worm gears, etc., automatically, in all sizes and angles, up to 2 feet in diameter, and can also be used for circular or continuous milling. It is not adapted for cutting bevel or internal gears.

A copy of the pamphlet advertising the Gear Hobbing machine manufactured by the **Reynolds Machine Co., Moline, Ill.**, has been received. The tool is well illustrated by no less than four cuts and its operation is described at some length. A cutter having the form of the teeth required is not used, but a hob having the shape of rack teeth which generates the proper curves on the gear teeth is employed instead. The machine cuts only spur gears.

**The Independent Pneumatic Tool Co. of Chicago and New York,** have issued a most attractive catalogue of their pneumatic tools. The book is printed on an excellent quality of paper and the cuts are exceptionally good. The various uses to which their wood and metal working tools can be employed are well illustrated. The book cannot but prove interesting and instructive to all those interested in this line of machinery.

**The Reynolds Pattern & Machine Co., Moline, Ill.**, have forwarded us a copy of their catalogue dealing with automatic screwdrivers. These machines are substantially constructed and from the way in which they are received by manufacturers, in both wood and iron working shops, are evidently quite capable of doing all that is claimed for them.

**The J. G. Blount Co., Everett, Mass.**, have forwarded us a copy of their 1912 catalog No. 14 in which their very complete line of grinding, buffing and polishing machinery is very tastefully illustrated. Another line which they manufacture is speed lathes. The various types of these machines are very pleasingly illustrated by a large number of excellent cuts. The splendid quality of their product is briefly but strongly emphasized in the catalog.

## BOOK REVIEWS.

Starting currents of transformers, with special reference to transformers with silicon steel cores, by Trygve D. Yensen, has just been issued as Bulletin No. 55 of the Engineering Experiment Station of the University of Illinois. Price, twenty-five cents.

FOR SALE
A Canadian Patent Packingless Globe Valve.
Something new. Best offer takes it.
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The transformer has come to be regarded as one of the most reliable and simple pieces of electrical apparatus. As new material, however, is utilized to increase its efficiency, new problems arise. One of these problems is the momentary rush of current that occurs upon closing the primary circuit of a transformer. In Bulletin No. 55 it is shown that while this starting current for old type transformers may rise as high as four times full load current, it may rise to more than seven times full load current for the new type with silicon steel cores. The phenomenon is fully explained and illustrated by means of oscillograms.

Tests of Columns. An Investigation of the value of Concrete as Reinforcement for Structural Steel Columns, by Arthur N. Talbot and Arthur R. Lord, has just been issued as Bulletin No. 56 of the Engineering Experiment Station of the University of Illinois. Price, twenty-five cents.

This bulletin gives an account of a series of tests to determine the strength of a structural steel column of considerable strength having a filling of concrete. The tests show that this type of column, if properly made, is a reliable and efficient structural member, and that nearly all the strength of both steel and concrete is developed. The tests also show that up to the point of failure of the column, the fireproofing shell of concrete adheres to the remainder of the column.

### MISCELLANEOUS.

**Toronto, Ont.**—A. J. Halford, Canadian representative of the English Bus Company which intends to operate buses on Toronto's streets, says that his company will erect factories in Toronto to cost for construction and equipment a half-million dollars. The difficulties arising from British labor troubles and shipping delays had led to a realization that to successfully operate buses in the cities of Canada they had to be surer of their supply than they were at the present time, when their buses come from England. It is the intention of the company to run buses, not only in Canada, but in cities of the States, Mexico, and the Central American countries. They will make all of them here, and as the numbers are expected to run up into the thousands yearly, it means a big plant, and the employment of many men. The site for the factory has not been secured yet, but Mr. Halford intimated that he had several properties under consideration.

**Hamilton, Ont.**—The Steel Castings Syndicate, a new company formed of Buffalo, Brantford, Toronto and Hamilton capital, has decided to locate here. C. W. Sherman, of Buffalo, late of Pratt & Letchworth, will be manager. The capitalization is $300,000.

**Byng Inlet, Ont.**—The two saw mills of Graces, Bigwood & Co., which burned here recently, were among the finest in Canada, having an output of about 55,000,000 feet per annum. The box factory, power plant (consisting of electric dynamos in a separate building), and the company's stock of lumber were saved. The fire is a serious blow to the town.

**Montreal, Que.**—If the plans of the Dominion Government do not miscarry, Montreal will soon possess the largest and most magnificent Customs examining warehouse in Canada.

**Edmonton, Alta.**—The whole of the above-ground plant of the West Coal Company at Clover Bar has been destroyed by fire, which did damage to the extent of from $35,000 to $40,000. The mammoth blaze broke out in the roof of the boiler room at the mine, spreading from that point until the entire buildings at and around the pit head were enveloped in the flames.

**Montreal, Que.**—Plans have been submitted by Messrs. Marchand and Haskell, architects, for the construction of an annex to the City Hall, ninety-four by one hundred and seventy-six feet, providing for an imposing gray sandstone building, whose cost, according to the lowest tender amongst those opened by the Board of Control, will be $649,000. This tender was made by the Peter Lyall & Sons Company, Limited; the next lowest being that of C. E. Deakin, $678,000, and the highest that of Mr. Joseph Bourque, $725,000.

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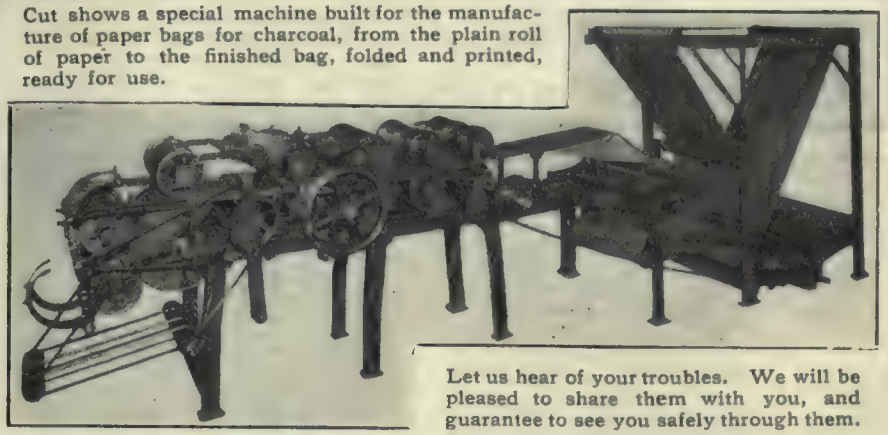
Cut shows a special machine built for the manufacture of paper bags for charcoal, from the plain roll of paper to the finished bag, folded and printed, ready for use.



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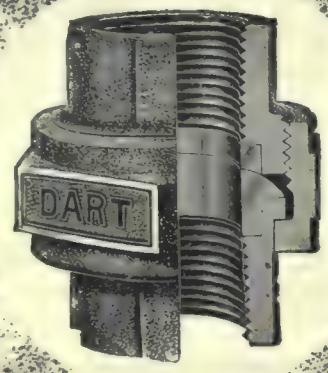


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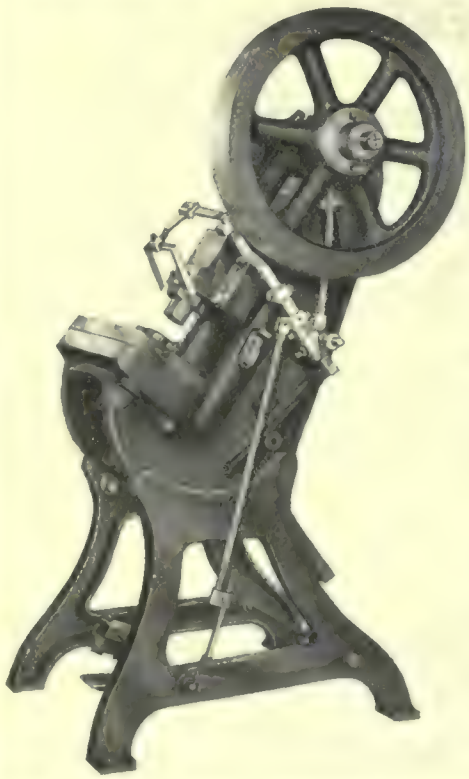

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FOR SALE—IDEAL PACKLESS VALVE CO. desire to dispose of their entire business, which is composed of over $9,000.00 worth of valve making machinery, tools and Patterns, also Letters Patent, for a high-grade, simple and durable Packless Valve. Can prove to anyone interested, the value of patent, also that the construction is the most perfect of anything yet on the market, can give references to many well-known people who are now using our valve. Will send printed list of inventory upon application. IDEAL PACKLESS VALVE CO., Walkerville, Ont.

GAS ENGINE FOR SALE—80 H.P. KYNOCH Gas Engine in good order and giving satisfaction. To be sold at good terms for an early buyer. Might also be exchanged for a Corliss Steam Engine of 80 H.P. with 2 return tubular boilers. The engine might be connected with direct generator of same h.p. Also Boiler 30 h.p., in good order, used one year; reasonable price. J. B. & A. Gaulin, St. Francois, P.Q.

MACHINERY FOR SALE—NEW AND SECond-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

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WANTED—A SECOND-HAND ENGINE OR gap lathe—24 in. swing x 12 ft. bed, or about. Albert Roy, General Machinist & Gunsmith Work, La Patrie, Que. (7)

WANTED—EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switch board and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (12y)

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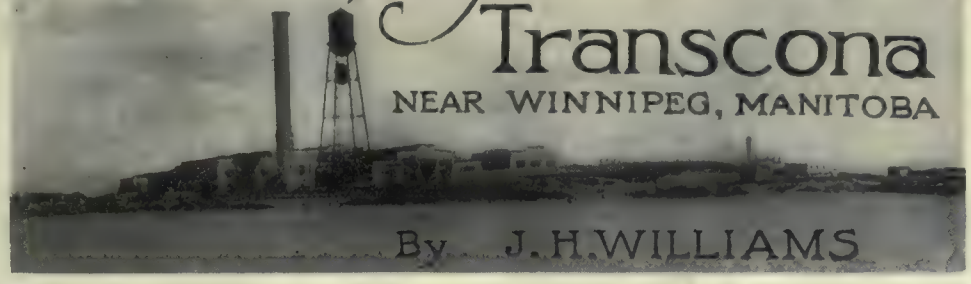
# New Shops of the N.T.R. Transcona

## NEAR WINNIPEG, MANITOBA



By J. H. WILLIAMS

### INTRODUCTORY AND PERSONAL.

THERE was published in Canadian Machinery for November, 1910, a preliminary account of the National Transcontinental Railway shops being built at Transcona, near Winnipeg, Man., with illustrations of the various buildings as they then appeared. Needless to say, great progress has been made since that time. with the result that the shops of the motive power department, together with the power house, are now ready for operation. These are herewith described. Some little time will necessarily elapse before the car shops are sufficiently advanced to permit of their complete description. In conjunction with the shops about to be built at Quebec, the Transcona plant is intended to handle repairs to all rolling stock from Winnipeg to the Atlantic, or rather to Moncton, N. B., which is technically the Eastern terminus of the line. The shops, of course, together with the track of the N. T. R., are to be leased to the Grand Trunk Pacific Railway, who will doubtless also use them for repairs to their Western lines rolling stock, until such time as the pressure of traffic renders necessary the building of other shops further West.

MAJOR R. W. LEONARD,
National Transcontinental Railway Commissioner.

### E. J. Chamberlin, President, G. T. P.

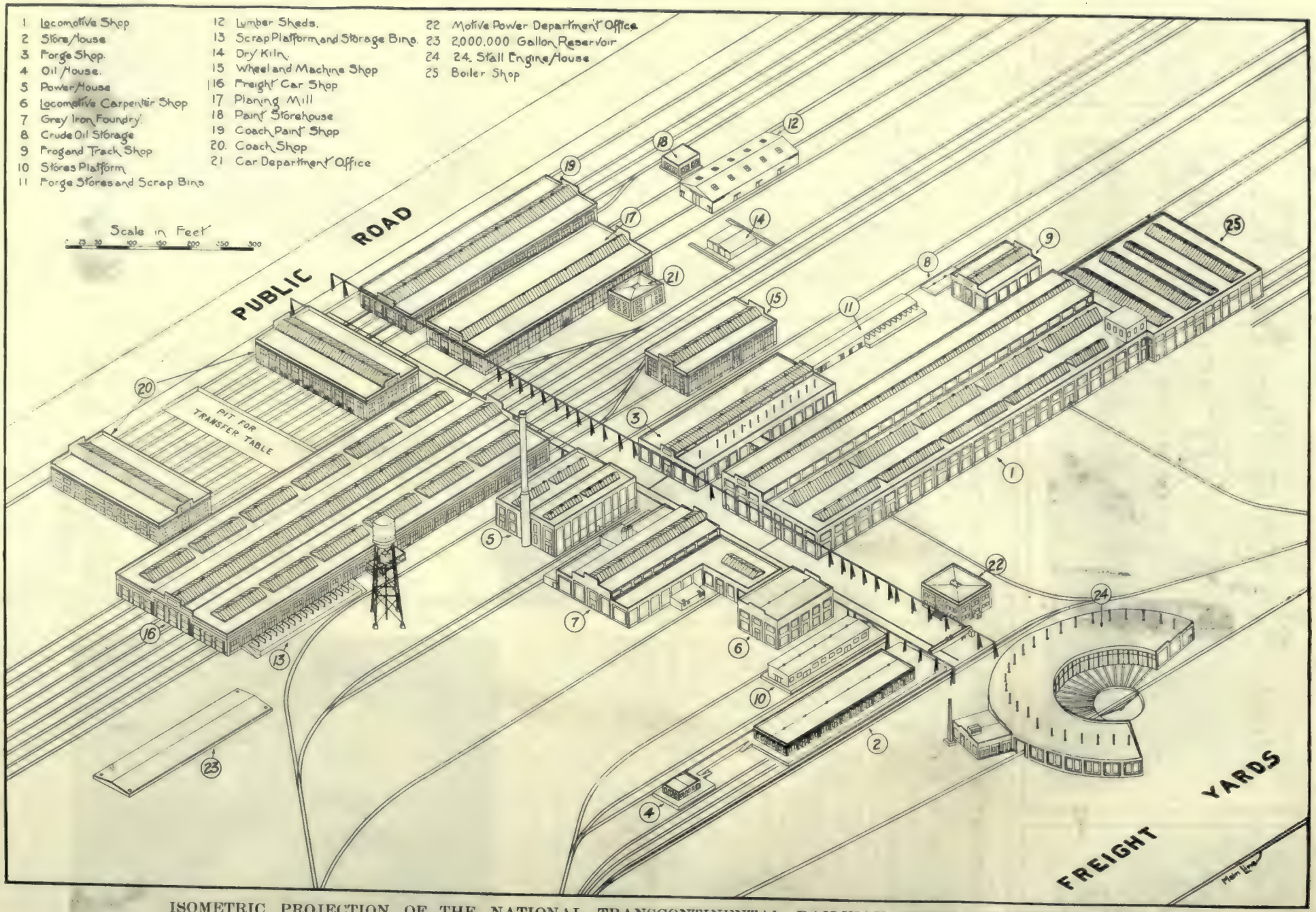
The new president of the Grand Trunk Pacific Railway, Mr. E. J. Chamberlin, whose portrait appears on page 189, is understood to be well satisfied with the shops and equipment at Transcona, and as a railroad man of forty years' experience, he is no mean judge in such matters. Mr. Chamberlin, who is a native of Lancaster, N. H., was educated at Montpelier Methodist Seminary. He began railroading in 1871, and in 1884 became superintendent of the Ogdensburg and Lake Champlain Railway. He was general manager of the Canada Atlantic Railway from 1886-1905, when, on its absorption by the G. T. R., he went to Mexico to supervise some large railway contracts. For four years he was president of the Morelia & Tascambra Railway; afterwards returning to Canada to take charge of the construction of the Grand Trunk Pacific Railway, of which he was made vice-president and general manager. His ability as a railway builder was demonstrated when he performed the construction work on the Canada Atlantic at a very low cost.

### W. J. Press, Mechanical Engineer.

The details of the locomotive shops were partly worked out by F. W. Walker, M.E., who held the position of Superintendent of Terminal Shops, N. T. R., until July 1, 1911, when he resigned. On May 23, 1910, W. J. Press, M. E., was appointed mechanical engineer and machinery expert, with headquarters at Ottawa; since which time he has had charge of the completion of the locomotive shops, the construction of the car shops, and has also been responsible for the selection and instalment of all

HON. GEO. P. GRAHAM,
Dominion Minister of Railways and Canals—"Laurier" Cabinet.

HON. FRANK COCHRANE,
Dominion Minister of Railways and Canals—"Borden" Cabinet.




ISOMETRIC PROJECTION OF THE NATIONAL TRANSCONTINENTAL RAILWAY SHOPS, TRANSCONA, MAN.

the mechanical equipment, not only in the shops, but along the whole line of the N. T. R.

Mr. Press has been engaged in railway work all his life. He served a seven years' apprenticeship with the South Australian Government Railways, and remained in that service twelve years, having charge of all contracts in connection with the car department, etc.

THE LATE C. M. HAYS,
Former President the Grand Trunk Pacific Railway.

At the outbreak of the Boer War, he was requisitioned for South Africa, and on arrival at Pretoria was attached to the Royal Engineers, under Sir Percy Girouard, who placed him in charge of the Imperial Military Railways' principal locomotive and carriage shops at Pretoria. During this period, Mr. Press constructed a number of the armoured trains which proved of so much service. In the course of the war, nearly one hundred locomotives, blown up by the Boers, were repaired in these shops, and much ingenuity had to be exercised in carrying out the repairs, owing to the lack of material and spare parts. In addition to the usual locomotive and car work, a great deal was done in the way of repairing ordnance, gun carriages, etc.

On the conclusion of hostilities, Mr. Press was appointed principal works manager of the Central South African Rlwys., with headquarters at Pretoria, and had charge of the Pretoria, Johannesburg and Bloemfontein locomotive and car shops. This position he held until January, 1904, when he resigned and came to Canada, entering the service of the Canadian Pacific Railway Co. as inspector of improved methods at their Angus Shops, Montreal. After about two years, he joined the sales force of Messrs. Mussens, Ltd., as manager, and remained with that firm until his appointment in May, 1910, to his present position.

Mr. Press is also in charge of the layout and equipment of the new Quebec shops of the N. T. R. Previous experience in this class of work has, therefore, clearly stood him in good stead, as any one will admit who has visited the Transcona shops. The arrangement of the equipment and of the shops generally make this, without a doubt, one of the finest railway plants in America, and it should enable the Grand Trunk Pacific Railway to overtake repairs at a minimum cost. Mr. Press has as assistant engineers at Transcona, D. A. Evans, H. Pinch and A. D. Porter, all of whom are men experienced in railway shop work.

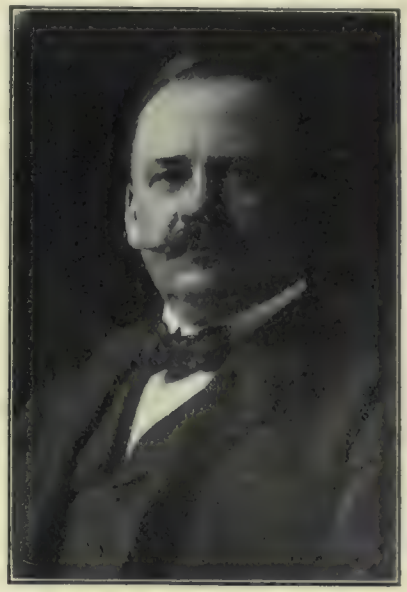
The contractors for the various buildings are Haney, Quinlan & Robertson, of Montreal; the work having been carried out under the direction of C. J. E. Maxwell, general superintendent. The contract for the supply and erection of the structural steel work was sub-let to the Manitoba Bridge and Iron Works, Ltd., Winnipeg; some 4,600 tons of steel having been used in the shops so far completed. The electric lighting and wiring have been installed by the Western Electric Co., and the tile conduits by G. M. Gest, Montreal.

### General Layout.

The shops are located on the prairie, six miles east of Winnipeg, and the whole area occupied by the buildings and tracks has been covered by a heavy gravel fill, 3 feet 6 inches deep, in order to raise the shop floors sufficiently above prairie level, to avoid all trouble from flooding in the spring. The whole property is 2½ miles long by ½ mile wide, and the total floor area of the shops when completed will be rather more than 17 acres. The plant has been designed to allow of a future extension of 100 per cent., and always keeping this in view, the grouping of the shops has been arranged as compactly as possible in order to facilitate intercommunication in winter.

W. J. PRESS, Mechanical Engineer and Machinery Expert, N.T.R.

As in the majority of large railway plants of modern design, the various buildings are situated on either side of a spacious midway. Their location is clearly seen in the cut on page 188, which shows a bird's eye view of the whole plant, as it will eventually appear. The midway is 1,200 feet long, and runs north and south; a public road terminating it at the north end, while the locomotive roundhouse is located at the south end. It is served by a 10-ton electric traveling crane of 73 feet span, and by industrial and standard gauge tracks. The crane has a traveling speed of 400 feet per minute, enabling material to be rapidly handled between the various shops. It has two hoisting speeds of 15 and 40 feet per minute respectively. The motors, gears, etc., are covered in as a protection against the weather, and the operator's cage is electrically heated in winter. The height of the crane rails above ground level is 28 feet.



E. J. CHAMBERLIN,
President, the Grand Trunk Pacific Railway.

The power house, as will be noticed, stands about half way along the midway on the west side, thus occupying a central position for the distribution of power, light and heat. The track, running at right angles to the midway, immediately north of the power house and forge shop, forms roughly speaking, the dividing line between the locomotive and the car departments; the latter lying to the north and the former to the

south. The power house, foundry, pattern shop, stores house, and forge shop all lie to the south of this line, but, of course, cannot be said to belong to one department more than another, since they serve both equally.

Extending the full length of the midway there is a 5 ft. x 6 ft. tunnel to accommodate the high and low pressure steam pipes and returns, together with the compressed air lines, etc. Tile conduits branch off to the various shops, and a short subway connects the tunnel with the power house. In this way the various pipe lines are distributed throughout the plant. An auxiliary chamber runs outside the tunnel and carries the electric cable conduits which are embedded in concrete, and at convenient intervals open into chambers accessible from the tunnel by means of doors.

Needless to say, all departments are connected by telephone, the exchange switchboard being situated in the storehouse. Protection against fire is afforded by two 1,000-gallon Underwriter fire pumps in the power house, from whence a complete system of piping is distributed throughout the plant. Fire hydrants and hose houses are located in suitable positions about the yard, while inside the shops, reels carrying 50 feet of 2½-inch hose, with 1 inch fire nozzle attached, are affixed to the columns at convenient intervals.

### Shop Lighting.

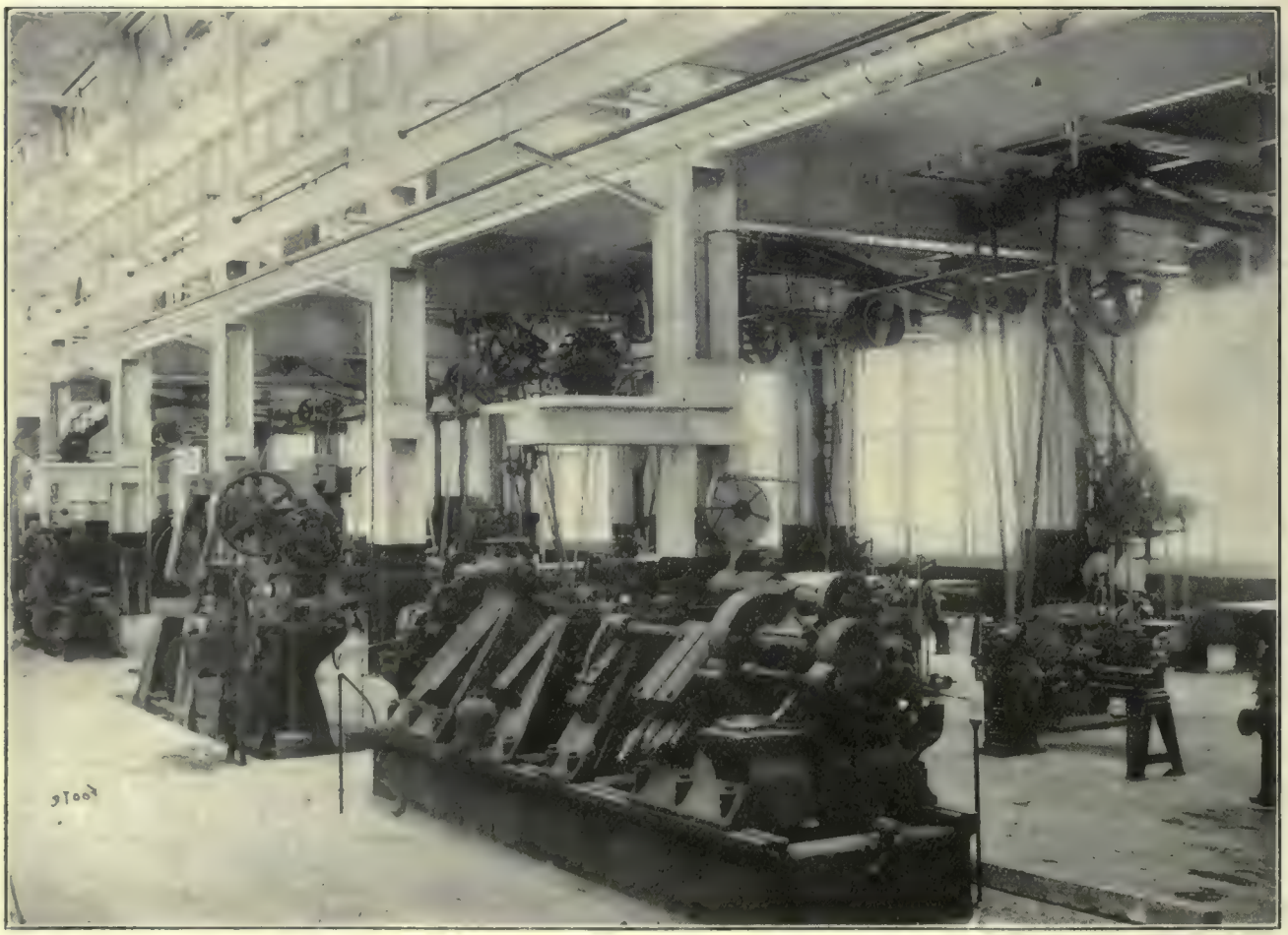
The general system of interior illumination is by Cooper-Hewitt A.C. mercury-vapor lamps of 700 C.P. each. Connections are also provided for incandescent drop lights and extension cables. A 600-volt feeder runs the full length of the midway tunnel with sub-feeders to transformers outside each shop. These reduce pressure from 600 to 200 volts to suit the mercury-vapor and incandescent lights. Throughout the shops already built, there have been installed 181 mercury-vapor lamps. These are all suspended high up in the roofs, well above the cranes, and are expected to give a steady light, free from shadow.

The midway and yards are lighted by Westinghouse series enclosed arc lamps. In the midway, these are carried from the crane runway, while in the yards they are supported by iron brackets on poles.

### Details of Shop Construction, Foundations, etc.

Except in the case of the storehouse, stores platform and oil house, the buildings all have self-supporting steel frames standing on reinforced concrete footings. These are carried down 11 feet to the clay, and are of such a size that the pressure per square foot in no case exceeds 5,000 lbs. The walls are of concrete up to the window sills, and rest on wide concrete footings. Above the window sills, the walls are of white brick, carried up into a parapet wall on all four sides of the building and topped off with a coping of concrete. The roofs are mostly covered with tar felt and asphalt, coated with gravel. All windows are of ⅛-inch ribbed glass set in wooden sashes. The skylights are supported by ¼ x 3 inch steel ribs, and are of ⅜-inch wire glass, carried by rolled copper sheathing. Rainwater, etc., is collected on the roofs in copper receiving hoppers and brought down inside the buildings by wrought iron pipes to the sewers. The shop floors are of 3-inch planks spiked to 4 x 6 inch timbers, bedded in bituminous concrete.

The various departments are treated in the following pages in separate articles, forming a connected whole. Being very fully illustrated, they give a good idea of the appearance of the shops, while the equipment is described in considerable detail.



View in Machine Shop, looking south-east. Bertram Driving Wheel Quartering Machine in foreground. Next to it is the 600-ton Wheel Press. Above the quartering machine is seen a motor for one of the group drives below the gallery.

# N.T.R. Locomotive Erecting and Machine Shops at Transcona

*This important sub-division of the complete article refers to the design of the machine shop, the crane equipment, the erecting shop pits, the provision of compressed air, the window layout for natural lighting, the individual motor drives for heavy machines and the group drives for those of a lighter type.*

THESE shops are contained in one large building situated on the east side of the midway. The building is 613 feet long and is divided longitudinally into three bays, having widths of 70, 60 and 40 feet respectively. The two latter bays, forming the heavy and general machine shops, will be dealt with later.

The 70 feet bay has a height to the roof truss chords of 50 feet, and forms the erecting shop. It lies on the north side of the building, and is arranged with twenty-five transverse locomotive pits, 43 feet long and pitched 24 feet centres. The bottom of each pit is lined with vitrified paving brick laid on edge, and has a slight fall to the north end, where a grating carries off all water to the sewer. The pit rails are laid on a continuous steel plate ½-inch thick, and are secured on the inside by 3 x 3-inch angles and steel clips, while on the outside, cast iron clips are used.

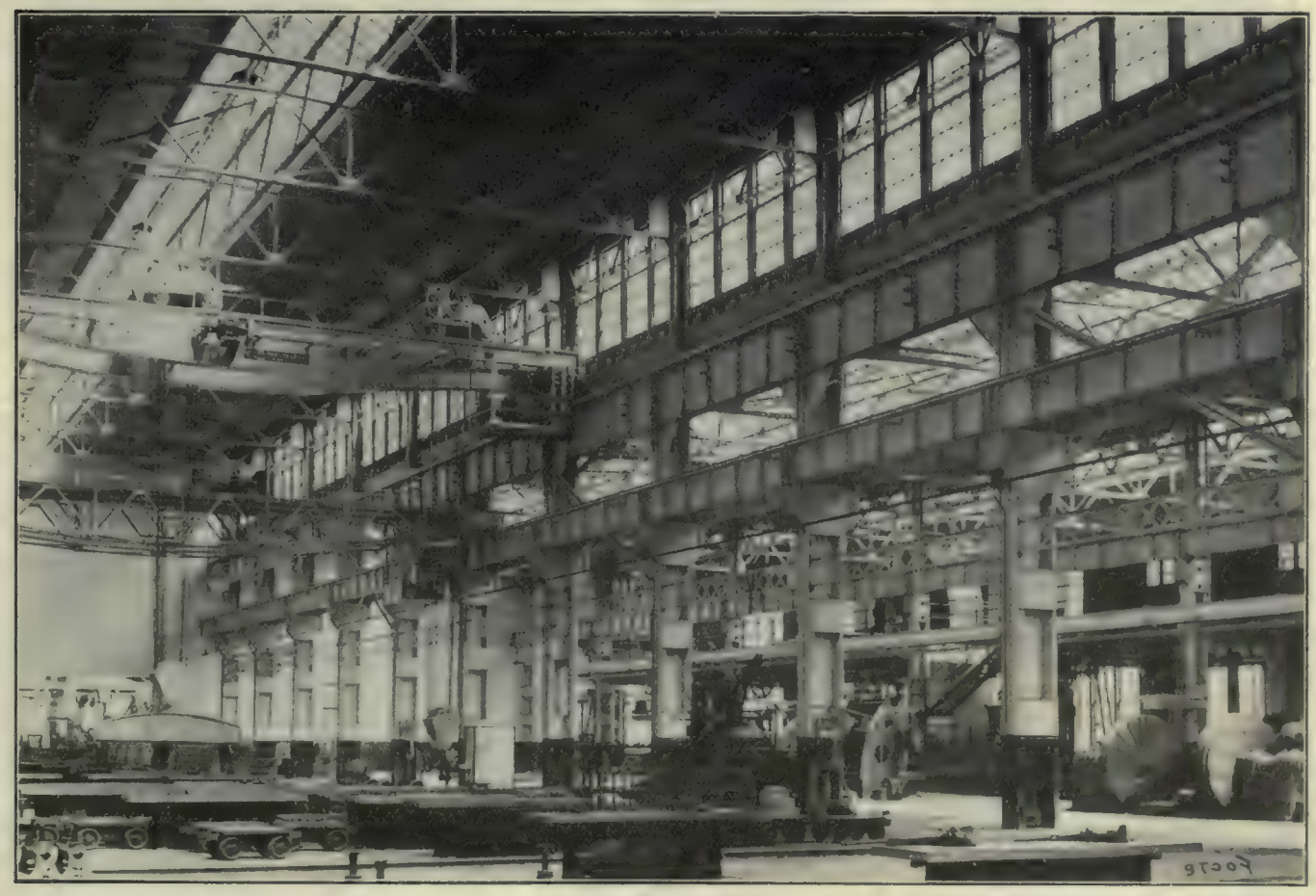
This is a great improvement on the usual method of fastening the rails to short ties. Each pit is provided at its south end with high pressure steam and water service pipes, while at the north end two ducts admit warm air; the shop being heated by the indirect radiation system. There are also four compressed air connections and two electric light sockets in every pit. Between the pits there are substantial work benches fitted with vises, drawers, etc., and having sockets for electric lights, while along the north side of the shop, at every fifth column, there is a motor driven 20-inch double emery grinder by the Bridgeport Safety Emery Wheel Co.

### Locomotive Crane Equipment.

There are two entrances to the erecting shop, located at the sixth pit from each end. The locomotives come in from the south tracks through the machine shop, and are then picked up by a 120-ton electric traveling crane, and carried to any required pit. This crane was built by the Morgan Engineering Co., Alliance, Ohio, and is of the double trolley five-motor type; each trolley having a capacity of 60 tons. The span is 67 feet 6 inches and the lift 39 feet. Each main hoist is operated by a 52 H.P. motor, each trolley cross-traversed by a 15 H.P. motor, and a 52 H.P. motor runs the crane up and down the shop. All gears and pinions are of steel, and all bearings are provided with split bronze bushings. The motors are of General Electric make, and take 3-phase current at 550 volts, 60 cycles, direct from the power house feeders, as do all the cranes throughout the plant.

### Booth Bros. Cranes.

Below the heavy crane there is a 10-ton messenger crane for handling the



Upper end of Locomotive Erecting Shop. On the upper runway is seen the 120-ton crane, and on the lower the 10-ton messenger crane. At the time this photograph was taken the work benches had not been distributed between the locomotive pits, hence the somewhat crowded appearance of the floor. The small trucks are for use on the industrial tracks in the Boiler Shop and elsewhere.

lighter material, such as cylinders, trucks, wheels, etc. This, a 3-motor crane with a span of 65 feet 2½ inches, was built by J. Booth & Bros., Ltd., Rodley, Leeds, England. It has a traveling speed of 300 feet per minute and a racking (cross-traverse) speed of 100 feet per minute. The load may be hoisted at 15 or 40 feet per minute, as desired. J. Booth & Bros. have supplied no fewer than eleven electric traveling cranes to the Transcona shops, and as they are all of the same general type, the present forms a suitable opportunity to describe their leading features. Their main girders are of the lattice type, stiffened laterally by lattice bracing attached to the outside of the end carriages. This makes a very rigid bridge and greatly reduces the tendency of the two ends of the crane to skew across the runway. The type of construction also gives a very wide platform from which to make adjustments, execute repairs, etc. Moreover, the lattice girders form a minimum of obstruction to the light from the skylights and windows, and hence tend toward a better lighted shop. The hoisting motion on these cranes is fitted with an overwinding device, which operates a switch in the hoisting circuit. It is also equipped with a patented mechanical brake, thus rendering it impossible for the load to drop at any point; in fact, the load cannot be lowered without sending reversing current to the hoisting motor.

There is also a mechanical brake, controlled by foot-lever in the operator's cage, for regulating the longitudinal traveling speed. The main rope sheaves are of the same diameter as the hoisting drums, thus ensuring an absolutely parallel lift. The hooks are of liberal dimensions, swivelling on ball bearings, and of sufficient weight to keep the ropes taut and prevent them buckling, when being lowered without a load. The Booth cranes are all equipped with motors manufactured by the Lancashire Dynamo & Motor Co., Ltd., and all fuses, switches, circuit breakers, etc., are entirely enclosed in order to eliminate any risk of accidental injury to the operator.

View looking west down Main Bay of Locomotive Machine Shop. Here are located the heavy individual motor-driven machine tools. This illustration gives a good idea of the appearance of the travelling cranes supplied by J. Booth & Bros., Ltd.

### Locomotive Pits Equipment.

In addition to the two traveling cranes, the erecting shop pits are further equipped with bracket cranes hinged to alternate columns along the porth side of the shop. Eoch crane serves two pits, and is furnished with a 2-ton Yale & Towne triplex chain block. The bracket cranes themselves were supplied by the Whiting Foundry Equipment Co., and will be used for assembling, dismantling and front end work generally. The locomotive pits are, of course, situated midway between the shop columns, and their tracks are extended well into the 60 feet (heavy tool) bay of the machine shop, so that when the 120-ton crane has lifted an engine off its wheels, the latter may be run into the machine shop and there carried by the traveler to the wheel lathes, wheel press, etc.

Besides the air connections in each pit, similar unions are provided on the columns between the erecting and machine shops. Air is used at 100 lbs. pressure, the main compressor unit being located in the power house and described in that section. In order to help out the main machine and to equalize the pressure all over the system, three smaller units have been installed; one in the boiler shop, one in the machine shop (below the gallery) and one at the west end of the heavy machine shop. These three compressors are of the vertical quick revolution motor driven type, built by Bellis & Morcom, Ltd., Birmingham, Eng., and are fitted with that company's well-known system of forced lubrication. Each compressor has a duty of 660 cubic feet of free air per minute with a pressure of 80-120 lbs. per sq. inch, at 290 R.P.M., and is direct connected to a 150 H.P Lancashire Dynamo & Motor Co.'s

A.C. motor. Separate receivers are provided, these being located underground outside the shop. Laurie & Lamb, Montreal, supplied these air compressors and also the motors that drive them.

### Natural Lighting Provision.

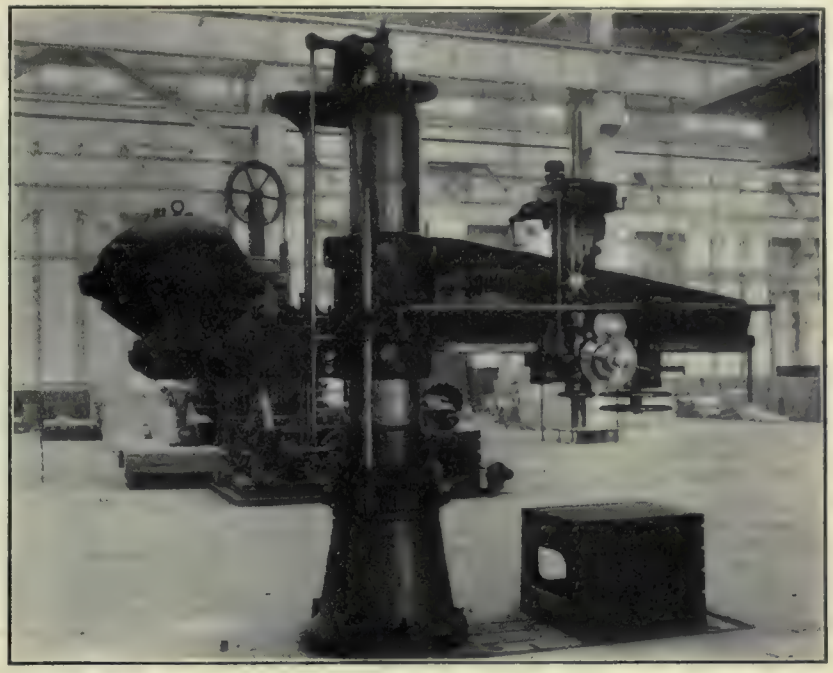
The natural lighting of the erecting and machine shops is excellent; ample window cases being provided in addition to skylights extending the full length of each bay. The upper windows can be opened and closed by chains from floor level, while the lower windows open by sliding vertically in the ordinary way. The bright and airy appearance of the shops is enhanced by having the interiors painted white.

### The Locomotive Machine Shop.

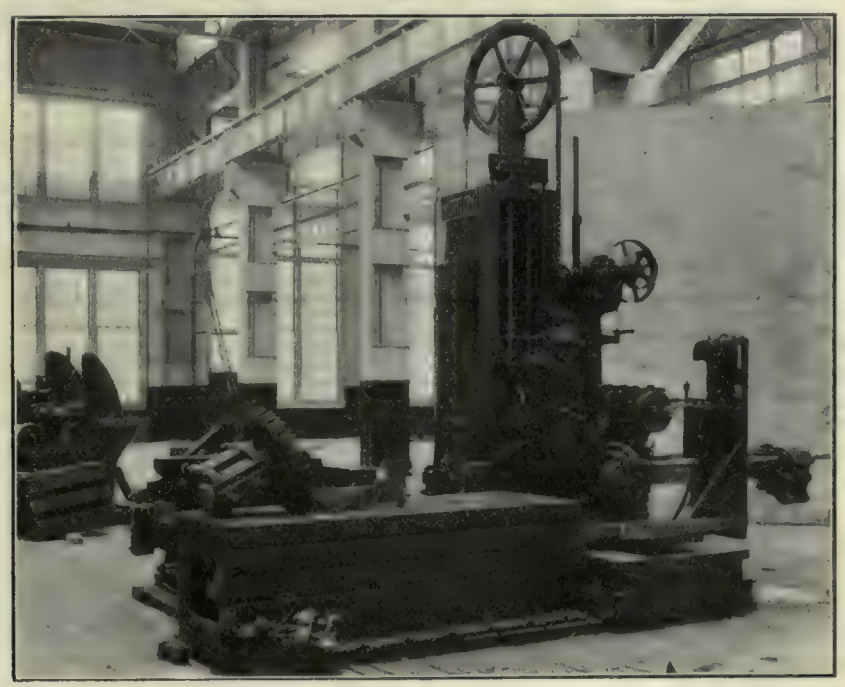
Opinions differ as to the best relative areas of machine shop and erecting shop floors. Among representative modern shops the ratio varies from .85 to 1.5. At Transcona the machine shop area, including the gallery, is 1.9 times that of the erecting shop; or if only that section of the gallery occupied by the brass department is included, the ratio is 1.45.

The machine shop, above mentioned, is in one building with the erecting shop, and consists of the centre and south bays of the building. The centre bay is 60 feet wide, while the south bay is 40 feet wide, with a gallery overhead. The centre or 60 feet bay is served by two Booth 10-ton cranes, similar to the messenger crane in the erecting shop, except that their traveling speed is 350 feet per minute, instead of 300 feet. The upper or east end of this centre bay is used for flue welding and tire setting, while the remainder of the bay is occupied by individual motor-driven machine tools.

The general layout of the locomotive erecting and machine shops may be seen from the plan on pages 194-195, which also shows the boiler and tank shop. The equipment of the flue department is very complete, and includes a Ryerson pit-type flue rumbler, fitted with chain cleaning device and driven by a 25 H.P. Lancashire motor. This rumbler is numbered 112 on the above mentioned plan, and is situated against the boiler shop wall. Near it are located the following tools: Ryerson combination hot saw and tube expander; Ryerson automatic safe-end cutting machine; Draper Manufacturing Co.'s pneumatic tube welder and swedger, and two oil-burning tube furnaces by F. Hyde & Co., Montreal. There is also an Underwood rotary flue cleaner, which will handle single 2-inch flues at the rate of 600 lineal feet per hour, and is intended as a standby in case of failure of the Ryerson rumbler. Nearby are the coppersmiths' and pipefitters' departments.



One of the many fine tools in the Locomotive Machine Shop—72-inch Central Thrust Radial Drill, by Wm. Asquith, Ltd.



The Morton Mfg. Co.'s 60-inch Draw-Stroke Cylinder Planer. On the table is seen the Rotary Planing attachment.

### Tire Department.

Proceeding west down the bay, the tire department comes next. For expanding tires there is a 96-inch tire furnace, supplied by F. Hyde & Co. This is heated by crude oil and will take eight tires at once. Alongside this furnace is a large steel tire floor, where the tires are shrunk on the wheel centres. A little further down the shop is a concrete lye vat, 23 feet long by 7 feet 6 inches wide by 8 feet deep. This is heated by live steam coils arranged round the bottom, and is covered in by steel cover plates, which can be readily removed by the traveler. This vat will, of course, be used for cleaning the grease off side rods, driving boxes, etc., and is of ample depth to take a pair of large driving wheels if necessary. The following table gives particulars of the various motor-driven machines in this bay; index numbers correspond to those on the plan, pages 194-195. Where the main driving motor is stated as

being D.C., it is understood to be of the variable speed type.

From a study of the list below in conjunction with the plan shown on these two pages, the grouping of the machines in this bay will be readily followed. Thus, the machines for axle-box work (F. 43, 113 and 113 A) are situated near the tire floor. No. 113 is one of the Morton Mfg. Co.'s special 32-inch draw-cut railroad shapers, fitted with jib crane and hoist, and equipped with attachment for planing axle-box brasses. Planer 114 will also be available for axle-box work when not engaged on shoes and wedges, for which it is principally intended.

**DETAILS OF MOTOR-DRIVEN MACHINES.**

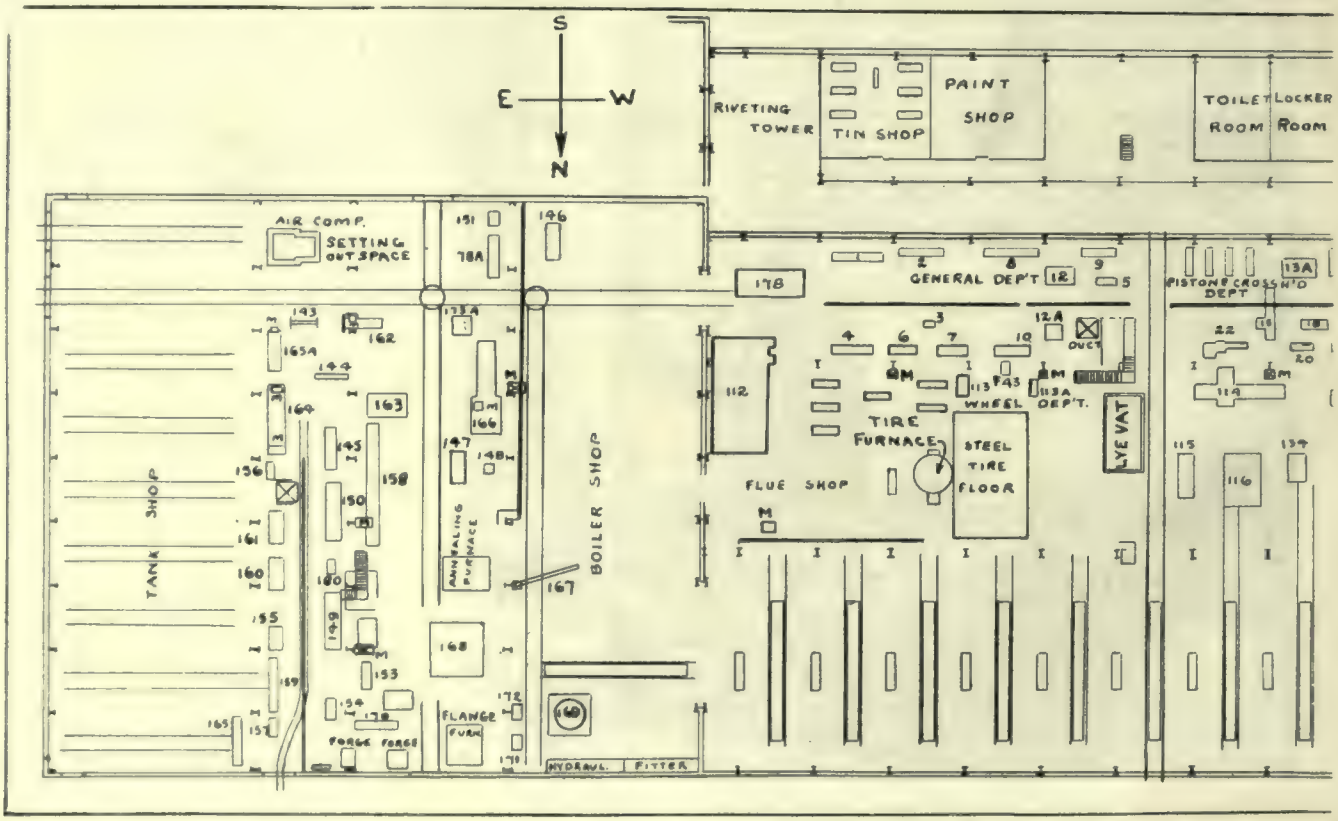
| Mach. No. | Class of Machine. | Size. | Maker. | Motor. | |
|---|---|---|---|---|---|
| F43 | Forcing Press | 50 tons | R. D. Wood | 5 | A.C. |
| 113 | Draw-cut Shaper | 32-inch | Morton | 7½ | D.C. |
| 113A | Slotter | 12-inch | Bertram | 5 | D.C. |
| 114 | Planer | 5x5x16 ft. | Canada Machinery Corporation | 30 | A.C. |
| 115 | Slotter | 24-inch | Dill | 7½ | D.C. |
| 116 | Boring Mill | 96-inch | Bertram | 5 | A.C. |
| | | | | 15 | D.C. |
| 134 | Radial Drill | 60-inch | Canada Machinery Corporation | 7½ | A.C. |
| 117 | Extension Gap Lathe | 28-55 inch | Bertram | 5 | D.C. |
| 119 | Hydraulic Wheel Press | 600 tons | R. D. Wood | 10 | A.C. |
| 121 | Quartering Machine | 90-inch | Bertram | two 5 | A.C. |
| 120 | Driving Wheel Lathe | 90-inch | Canada Machinery Corporation | 5 | D.C. |
| | | | | 50 | D.C. |
| 122 | Driving Wheel Lathe | 80-inch | Bertram | 30 | D.C. |
| 125 | Planer | 5x5x16 ft. | Redman | 50 | D.C. |
| 126 | Planer | 5x5x16 ft. | Canada Machinery Corporation | 30 | A.C. |
| 128 | Draw-cut Shaper | 26-inch | Morton | 5 | D.C. |
| 129 | Draw-cut Shaper | 30-inch | Morton | 5 | D.C. |
| 130 | Boring Mill (Niles type) | 72-inch | Bertram | 3 | A.C. |
| | | | | 15 | D.C. |
| 131 | Boring Mill | 42-inch | Canada Machinery Corporation | 7½ | D.C. |
| 127 | Combination Heavy Vertical and Horizontal Miller | No. 5 Knee type | Ingersoll | 20 | A.C. |
| 132 | Slotter (Dill type) | 18-inch | Canada Machinery Corporation | 7½ | D.C. |
| 118 | Radial Drill | 72-inch | Asquith | 10 | D.C. |
| 133 | Draw-cut Cylinder Planer | 60-inch | Morton | 2 | D.C. |
| | | | | 12 | D.C. |
| 135 | Cylinder Borer | | Bertram | 15 | D.C. |
| 137 | Draw-cut Shaper | 26-inch | Morton | 5 | D.C. |
| 136 | Heavy Vertical Rod Miller | 18-inch | Betram | 10 | D.C. |
| 136A | Side Rod Drill | 2 spindles | Bertram | two 10 | D.C. |
| 123 | Heavy Slab Miller | 3x3x14 ft. | Canada Machinery Corporation | 30 | D.C. |

### Wheel Department.

The wheel department comes next, and is fully equipped with 96-inch Bertram boring mill (116); 24-inch Dill slotter (115); two heavy wheel lathes (120 and 122); hydraulic wheel press (119); quartering machine (121); etc., etc. The Bertram boring mill is one of that company's latest type, fitted with friction cones for quickly cross traversing the heads on the cross rail and adjusting the tool bars vertically. The cross rail is raised or lowered by a 5 H.P. alternating current motor, while the mill itself is driven by a 15 H.P. variable speed motor.

The driving wheel quartering machine (121) is of the standard Bertram pattern, adjustable for any length of stroke from 16 to 40 inches. Each boring bar is driven by a 5 H.P. induction motor, and has two feeds and speeds and 12-inches traverse. This machine is equipped with a 2-ton jib bracket crane, as is also the 600-ton wheel press. The right hand head of the 90-inch wheel lathe is moved along the bed by an independent 5 H.P. motor operating through screw and friction gear drive; the function of the latter being to provide against breakage should the heads meet with any obstruction.

The tool posts are fitted with a powerful pneumatic clamp, shown on page 201. This clamp is designed to grip any tool used in turning tires. The vertical bolts are placed to allow of the broad forming tools being put in or taken out from either side. A double acting cylinder, taking air from the shop system, is contained in the body of the top slide. The piston operates through




PLAN OF LOCOMOTIVE, BOILER AND TANK

a rear bell crank lever A on the top clamp lever B, which in turn clamps the tool down upon its seat through a pressure plate C. A simple equalizing device is introduced between the top clamp lever and the pressure plate, so that the pressure on the tool is evenly distributed regardless of the setting of the adjustment nuts on the vertical bolts.

View in machine shop showing two of the automatic screw machines in Bolt Department

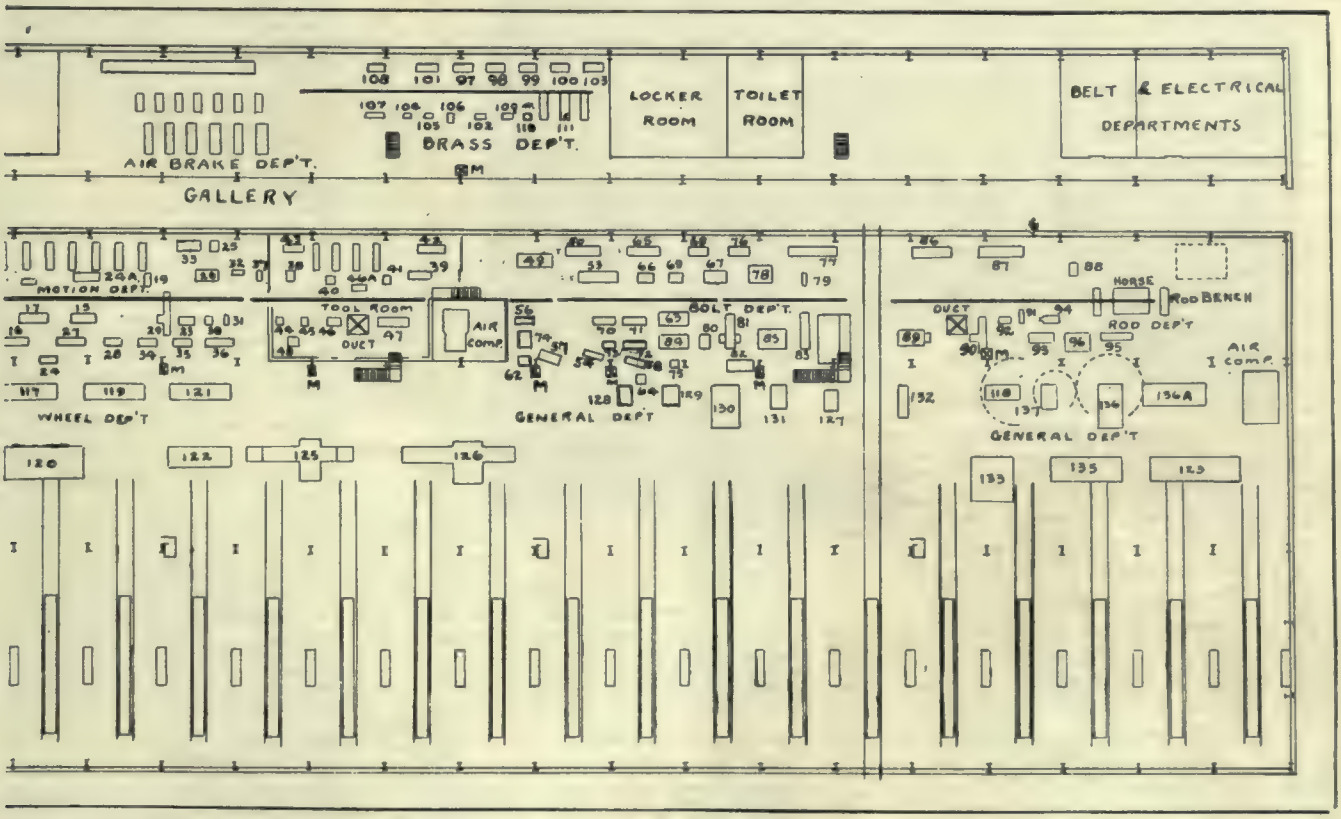
The clamp is controlled entirely by a single lever operating a four-way cock. Both wheel lathes (120 and 122) have the motor mounted on the left hand head, driving being direct through rawhide pinions.

Next to the wheel group, and in the middle of the bay, are the two 60-inch planers (125 and 126). These will be used for general work and are equipped with two side heads, in addition to the two heads on the cross rail. The centre of the bay for about 140 feet west of these planers is at present unoccupied and provides space for marking-off tables and storage of forgings, castings, etc., awaiting machining.

The south side of the bay at this point is occupied by a group of motor-driven tools for general work. These include 26-inch and 30-inch Morton draw-stroke pillar shapers (128 and 129). Each is provided with a jib crane and hoist and can take the special attachments supplied with the 32-inch machine (113) in the axle-box department. Next to these stand two boring mills for general work. The first (130) is a Bertram 72-inch mill with motor-elevated cross rail, and the other is by the Canada Machinery Corporation. The latter has a 42-inch table, fitted with combination 4-jaw chuck. This machine is equipped with foot power brake. Nearby is an Ingersoll heavy duty combination milling machine (127) with two spindles, one horizontal and one vertical. The drive is by a Morse chain from a 20 H.P. motor and is the only chain drive in the shop. This machine will be used for keyseating axles and general milling work.

**Rod and Cylinder Work Department.**

On the west side of the through track to the erecting shop are eight machines, which form what is classed as another general department, though they will be principally engaged on rod and cylinder work. No. 132 is an 18-inch Dill-type slotter by the Canada Machinery Corporation. Next to it is a very fine 72-inch radial drill of the central thrust type, of which an illustration is given on page 193. This drill was built by Wm. Asquith, Ltd., Halifax, England, and presents several features of interest. The portion of the arm in which the spindle works is of box girder form with walls of very stiff section. The spindle works midway between the walls, thus ensuring a central thrust. The thrust pressure on the spindle is taken by ball bearings and the arm, as may be seen, is counterbalanced by the




SHOPS, SHOWING ARRANGEMENT OF MACHINE TOOLS.

motor. The machine is double geared and is driven by a 10 H.P. variable speed motor, running at 300-1200 R.P.M. When in double gear, the spindle may be reversed, thus making it available for tapping and studding. This drill will be used for general and cylinder work, it being located near the group of cylinder machines.

Among other tools included in this group is a 60-inch Morton draw-stroke cylinder planer (133), equipped with special extension head and with port-milling and rotary planing, boring and milling attachments. The Morton cylinder planer is now to be found in a large number of railway shops, and needs no lengthy description here. Next to this planer stands a special Bertram cylinder boring machine (135), arranged to bore cylinder barrel and piston-valve chamber at one operation. Nearby is a heavy slab miller (123) which will be used chiefly on rod work. Opposite the two last mentioned machines are three others (137, 136 and 136A), all of which belong to the rod department. The first is a 26-inch Morton draw-cut shaper; the second a Bertram heavy duty vertical miller, and the last a Bertram double spindle side rod drill.

### The 40 ft. Bay and Gallery.

The south bay of the machine shop, as previously mentioned, is 40 feet wide and has a gallery overhead. The machine tools in this bay are all belt driven and are divided up into nine groups. Each group, with the exception of No. 9 (at west end of bay) is driven by a 20 h.p., Canadian Westinghouse A.C. motor. Group 9 comprises the machines used for guide bar, rod and general work, and is driven by a 30 h.p. motor. All group motors throughout the plant take current direct from the power house circuits at 550 volts, 3-phase, 60 cycles, and are carried on wooden platforms supported by channel iron brackets riveted to the shop columns; the arrangement being clearly shown in the illustration on page 190. The location of these motors is indicated on the plan of the shop by the letter (M).

The nine line shafts below the gallery are in accurate alignment with one another, and wherever feasible, the ends of adjacent shafts are brought within about ½ inch of each other, so that should a group motor break down badly, it will be an easy matter to fit a coupling to the ends of the two shafts and thus drive the two groups by one motor until repairs are made or a new motor substituted. The main line shafting is all cold rolled steel, 2 15-16 inches diameter, and runs at 180 r.p.m. in Chapman double ball bearings supported in 24-inch cast iron hangers. The latter are carried by steel stringers formed of

**GROUP 1.—GENERAL DEPT.**

| No. of Machine | Class of Machine | Size. | Maker. |
|---|---|---|---|
| 1 | Double back-geared engine lathe | 26"x14' | Canada Machinery Corporation |
| 2 | Engine lathe with taper attachment | 28"x15' | Canada Machinery Corporation |
| 8 | Single pulley engine lathe | 32"x16' | Dean, Smith & Grace. |
| 4 | Single pulley engine lathe | 24"x12' | Dean, Smith & Grace. |
| 6 | Travelling head shaper | 16" (55 in Traverse) | Bertram |
| 3 | Double emery grinder | 20" | Norton |
| 7 | Radial drill | 60" | Canada Machinery Corporation |
| 10 | Horizontal boring mill | No. 3 | Geo. Richards & Co. |

**GROUP 2.—GENERAL DEPT.**

| | | | |
|---|---|---|---|
| 12 | Vertical boring mill | 52" | Bertram |
| 9 | Double back-geared engine lathe, taper attachment | 30"x14' | Bertram |
| 5 | Bolt lathe, with taper attachment | 14" | R. McDougall Co. |
| 12A | Vertical boring mill | 42" | Bullard |

**GROUP 3—PISTON AND CROSSHEAD DEPT.**

| | | | |
|---|---|---|---|
| 22 | Slab miller | 24"x24"x10' | Canada Machy. Corporation. |
| 13 | High speed planer | 3'x3'x8' | Bateman |
| 13A | Piston rod grinder | 16"x72" | Landis |
| 20 | Engine lathe with taper attachment | 16"x7' | R. McDougall Co. |

**GROUP 4—MOTION DEPT.**

| | | | |
|---|---|---|---|
| 18 | Radial drill | 48" | Bertram |
| 17 | Radial drill | 66" | Asquith |
| 15 | Radial drill | 36" | Canada Machy. Corporation. |
| 16 | Bolt lathe with taper attachment | 16" | Canada Machy. Corporation. |
| 27 | Engine lathe | 20"x10' | Canada Machy. Corporation. |
| 28 | Engine lathe with taper attachment | 16"x7' | R. McDougall Co. |
| 34 | Engine lathe with taper attachment | 16"x7' | R. McDougall Co. |
| 35 | Engine lathe with taper attachment | 16"x7' | R. McDougall Co. |
| 36 | Engine lathe with taper attachment | 18"x10' | R. McDougall Co. |
| 29 | Planer | 2'x2'x6' | Mussens |
| 24A | Link grinder | 36"x14' | H. G. Hammett |
| 19 | Forcing press | 50 tons | Canadian Boomer & Boschert |
| 33 | Universal grinder | 12"x36" | Alfred Herbert |
| 25 | Shaper | 16" | Canada Machy. Corporation. |
| 26 | Slotter | 10" | Bertram |
| 30 | Vertical drill | 14" | W. F. & John Barnes |
| 31 | Hacksaw | 4" | Williams & Wilson |
| 32 | Buffing machine | .. | Bridgeport |
| 23 | Double emery grinder | 18" | Bridgeport |
| 124 | Disc grinder | 26" | Besly |

**GROUP 5—TOOL ROOM.**

| | | | |
|---|---|---|---|
| 37 | Double disc grinder | 18" | Gardner |
| 43 | Tool room lathe | 14" | Hendey |
| 38 | Universal shaper | 16" | Potter & Johnston |
| 40 | Turret drill | 6 spindle | A. D. Quint |
| 46A | Speed lathe | 12" | F. E. Wells & Sons |
| 41 | High speed drill | 2 spindle | Alfred Herbert |
| 39 | Tool room lathe | 14" | Hendey |
| 42 | Tool room lathe | 18" | Canada Machy. Corporation |
| 47 | Engine lathe with taper attachment | 22"x10' | R. McDougall Co. |
| 48 | Horizontal miller | 34"x10"x20" | Alfred Herbert |
| 44 | Twist drill grinder | .. | New Yankee |
| 45 | Cutter and reamer grinder | No. 4 | Alfred Herbert |
| 46 | Tool grinder | .. | Gisholt |

**GROUP 6—BOLT DEPT.**

| | | | |
|---|---|---|---|
| 49 | No. 4 hollow hex. turret lathe | 3½"x42" | Alfred Herbert |
| 56 | Bolt lathe with taper attachment | 14" | R. McDougall Co. |
| 74 | Triple bolt cutter | 1½" | Landis |
| 62 | Double emery grinder | 18" | Norton |
| 57 | Automatic screw machine | 1½"x5½" | Alfred Herbert |

**GROUP 7.**

| | | | |
|---|---|---|---|
| 50 | No. 3 hollow hex. turret lathe | 3"x36" | Warner & Swasey |
| 53 | No. 2 hollow hex. turret lathe | 2"x30" | Alfred Herbert |
| 65 | Nut facer | 3" | Jones & Lamson |
| 66 | Nut facer | 3" | Victor |
| 69 | 4-spindle nut tapper | 2" | National Machinery Co. |
| 67 | Bolt cutter | 2" | Bertram |
| 68 | Screw machine | 1½" | Warner & Swasey |
| 70 | Bolt lathe with taper attachment | 14" | F. E. Reed Co. |
| 71 | Bolt lathe with taper attachment | 16" | F. E. Reed Co. |
| 72 | Bolt lathe with taper attachment | 16" | F. E. Reed Co. |
| 73 | Centreing machine | 4" | D. E. Whitton |
| 54 | Automatic lathe | 3¼"x8" | Gridley |
| 58 | Automatic screw machine | 2¼"x6½" | Cleveland |
| 64 | Turret drill | 6 spindles | A. D. Quint |
| 75 | Turret drill | 6 spindles | A. D. Quint |
| 63 | 2-spindle drill | No. 4 Morse taper socket | Webster & Bennett |
| 84 | 2-spindle drill | No. 5 Morse taper socket | Webster & Bennett |
| 80 | Shaper | 16" | Canada Machy. Corporation |

**GROUP 8—GENERAL DEPT.**

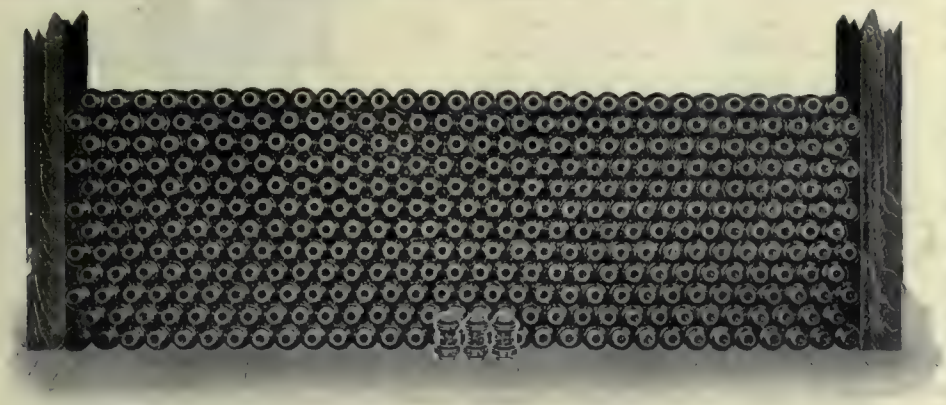
| | | | |
|---|---|---|---|
| 76 | Engine lathe | 16"x7' | Canada Machy. Corporation |
| 77 | Double back-geared engine lathe | 30"x14' | Bertram |
| 78 | Triple bolt cutter | 2" | Bertram |
| 79 | Grindstone | 36"x36" | Cleveland Stone Co. |
| 81 | High speed planer | 30"x30"x6' | Bateman |
| 85 | Vertical boring mill (with side head) | 36" | Geo. Richards & Co. |
| 83 | Planer | 26"x26"x6' | Bertram |
| 82 | Engine lathe with taper attachment | 20"x10' | Canada Machy. Corporation |

**GROUP 9—GUIDE BAR AND ROD DEPT.**

| | | | |
|---|---|---|---|
| 86 | Double spindle lathe | 32"x54" | McCabe |
| 88 | Forcing press | 30 tons | Canadian Boomer & Boschert |
| 87 | Double back-geared engine lathe | 36"x12' | Bertram |
| 89 | Radial drill | 48" | Bertram |
| 90 | Guide bar grinder | 30" ring wheel | Bridgeport |
| 92 | Double emery grinder | 20" | Bridgeport |
| 91 | Grindstone | 36"x6" | Cleveland Stone Co. |
| 94 | Turret drill | 6 spindles | A. D. Quint. |
| 93 | Vertical turret boring mill | 36" | Bertram |
| 96 | Vertical boring mill | 42" | Bullard |
| 95 | Engine lathe | 20"x10' | Canada Machy. Corporation |

double 4-inch channels, which are locked to the gallery floor girders in such a way that it is impossible for them to slip, no matter how great the belt pull.

**The Chapman Double Ball Bearings Co., of Canada,** supplied all the ball bearings and hangers for the main line shafts throughout the plant; the total



A shipment of 369 Chapman Double Ball Bearings, 2 15-16 inch dia., for N.T.R. Shops, Transcona.

number of bearings in the order being 369. This is the largest installation of one size of this bearing in Canada and forms one of the largest orders ever filled by the company. The provision of these bearings was certainly a wise move on the part of the N. T. R., as by their use the friction eliminated will mean a yearly saving of many horse-power, besides a large economy in the matter of oil.

The main line shafts are equipped with split wood pulleys, specified to be "Dodge or equivalent make." The pulleys supplied with the countershafts of course vary, some being of steel, some of cast iron, and some of wood, according to the ideas of the firm supplying the machine which each one drives. The millwright work has been given much careful thought and attention; no belt drives are at less than 8 feet centres, and down belts all have a good angle. In no case is it necessary for an operator to go behind or to the side of his machine in order to reach the belt shifter, the latter in every case being located where he can easily handle it from the front. The same remark applies to the controllers for the motor-driven machine tools in the 60-foot bay, which are all in positions convenient to the operator's hand. Material is conveyed to and from the machines under the gallery by shop floor trucks. At a later date it may be necessary to put in an industrial track, a clear passage way having been left from east to west to allow of this. Each machine requiring such service is equipped with a traveling air hoist, placed in such a position that the operations necessary in handling material are reduced to a minimum.

**General Department.**

The table opposite gives particulars of the machines below the gallery; the groups being numbered from the east end. The plan of the shop on pages 194-195 clearly shows the class of work for which each group is primarily intended.

From foregoing list it will be seen that the equipment is all high class and conveniently laid out, with ample room round each machine. The tool room is situated about half way down the bay and is entirely enclosed from the rest of the shop by match boarding and expanded metal screens. No hardening furnaces have as yet been installed, but these will doubtless be added later. Adjacent to the tool room is the air compressor room, housing the Bellis & Morcom compressor already referred to. Above this room is the foreman's office.

**The Gallery.**

Access to the gallery is had by the three stairways indicated on the plan. These are of steel with concrete treads, and the floor of the gallery is also of concrete. The gallery does not extend quite the full length of the shop, 38 feet being cut off at the east end to form the boiler shop riveting tower, which will be described when dealing with the boiler and tank department. The gallery accommodates the tin, air brake and brass shops as well as the lavatory and locker rooms and the Sturtevant heating apparatus.

**Tin and Paint Shop—Locker and Toilet Rooms.**

At the east end is the tin shop, which is fully equipped with the usual tinsmiths' tools, including shears, groovers, formers, folders, etc. These were supplied by the Brown, Boggs Co., Hamilton, Ont., and others. Next to the tin shop is the paint room, where is stored the paint used in the locomotive and tank shops. To the west of the paint store stands one of the three sets of heating apparatus, to be presently described. Next comes a toilet room and locker room, each equipped with high class fixtures. The locker room, of which an illustration is given on this page, contains steel lockers arranged in two tiers and fitted with expanded metal doors. The wash basins in this room, and in all others throughout the various shops, are of porcelain, and have hot and cold water laid on. In addition to the two toilet rooms on the gallery, there are four urinal stands spaced at equal distances down the heavy machine shop at the foot of the columns dividing that shop from the erecting shop.

One of the Lavatory and Locker Rooms.

**Air Brake Dept.—Brass Dept.**

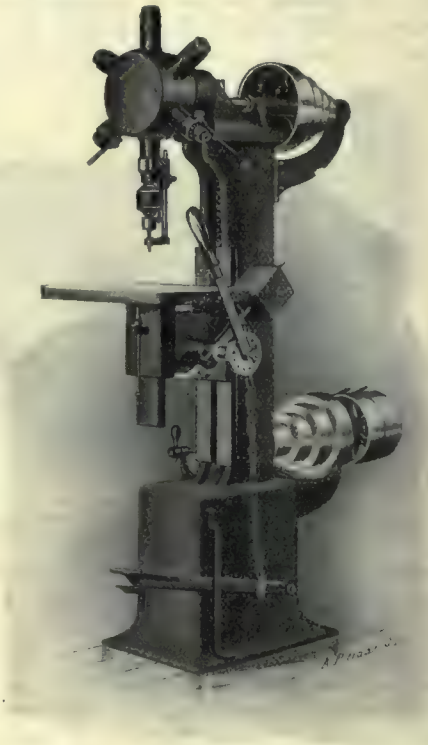
The next section on the gallery to be noted is the air brake department. This is served by a Canadian Rand air hoist

running on a hand operated traveler, enabling every part of the floor to be reached. The shop is equipped with standard Westinghouse testing apparatus, together with the usual stands for air pumps, etc. Next is found the second of the three heating units, and then comes the brass shop. The machines here are 15 in number, all operated from one line shaft. The latter is 2 15-16 inches diameter carried in 24-inch hangers fitted with Chapman double ball bearings, like the shafting below the gallery. Here again no wood beams or stringers are used; the hangers being suspended from channels supported by the roof trusses. This line shaft is driven by a 20 h.p. Canadian Westinghouse A.C. motor, and runs at 180 r.p.m. The brass shop has a length of 95 feet and contains the following machines:—

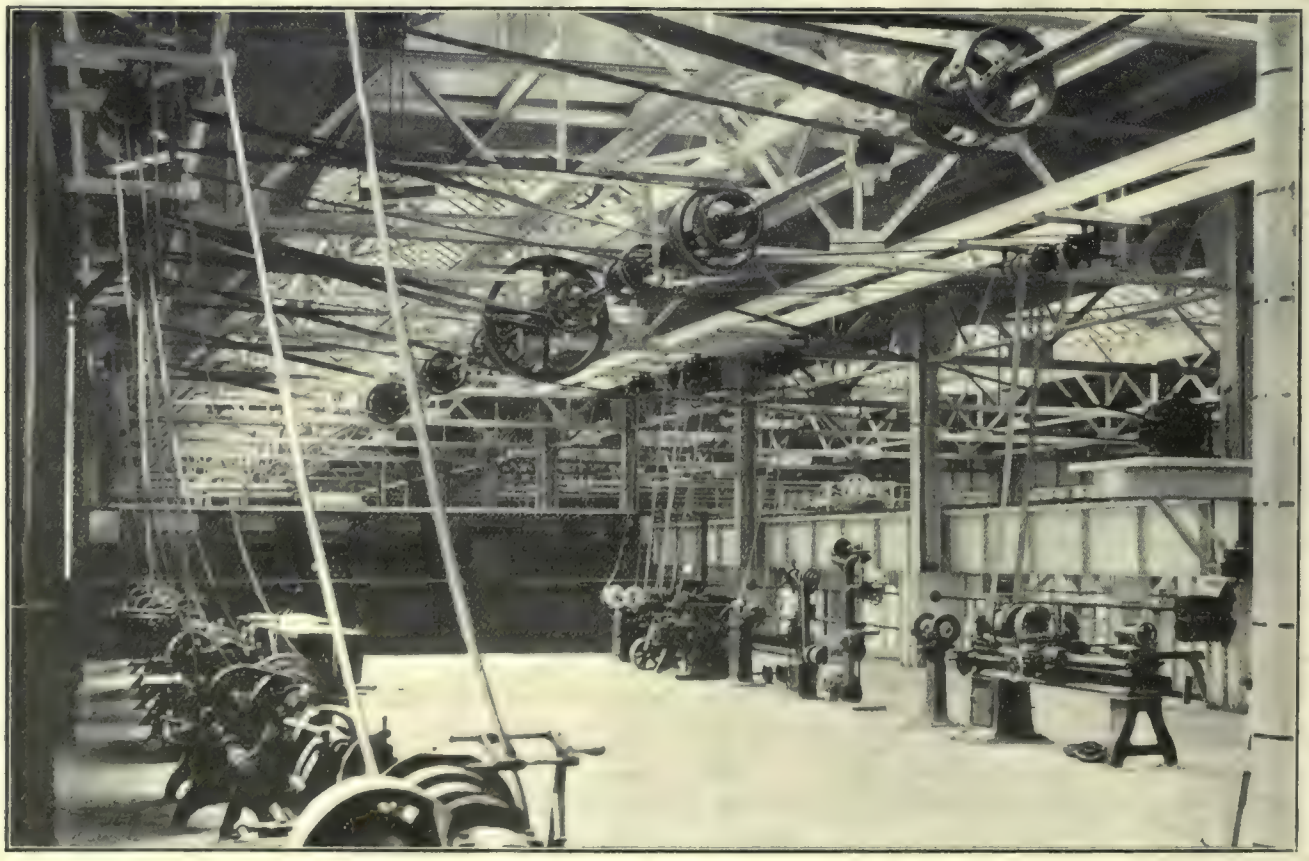
| No. of Machine | Class of Machine | Size. | Maker. |
|---|---|---|---|
| 108 | Monitor lathe with taper attachment. | 16″ | Dreses Mach. Tool Co. |
| 101 | Geared head monitor lathe ..... | 18″ | Alfred Herbert |
| 97 | Engine lathe ..... | 18″x6′ | R. McDougall Co. |
| 98 | Geared head monitor lathe ..... | 18″ | Warner & Swasey |
| 99 | Geared head monitor lathe ..... | 18″ | Warner & Swasey |
| 100 | Geared head monitor lathe ..... | 18″ | Warner & Swasey |
| 103 | Engine lathe with taper attachment. | 18″x6′ | Canada Machy. Corporation |
| 107 | Engine lathe with taper attachment. | 18″x6′ | Canada Machy. Corporation |
| 104 | Vertical drill press ..... | 24″ | R. McDougall Co. |
| 105 | Turret drill ..... | 6 spindles | A. D. Quint |
| 106 | High duty crank-driven shaper..... | 14″ | Gould & Eberhardt |
| 102 | 2-spindle miller ..... | .. | Warner & Swasey |
| 109 | Buffing machine ..... | .. | Bridgeport |
| 110 | Cock grinder ..... | .. | Warner & Swasey |
| 111 | Double emery grinder ..... | 18″ | J. G. Blount |

Immediately west of the brass shop is a second set of locker and toilet rooms; and next to these, the third heating unit. The remainder of the gallery is occupied by the quarters of the belt men and electricians. The three heating units on the gallery were supplied by the B. F. Sturtevant Co., and are designed to maintain the shop at a temperature of 60 degs. F., when the thermometer outside stands at 25 degs. below zero. The system is that of indirect radiation; large fans drawing in air between pipe coils heated by exhaust steam from the power house and by the fan engine exhaust, and delivering the heated air through vertical square steel ducts to concrete ducts below the shop floor, from whence it issues into the shop from openings along both walls under the windows and at the north end of each locomotive pit in the erecting shop. The vertical ducts are shown on the plan of the shop, page 195, and serve as a guide to the location of the heater units on the gallery above.

It must be remembered, when reading the lists of equipment, that these shops are intended to handle repairs only. No new locomotives will be built—for the present at all events.



One of the Quint 6-Spindle Turret Drills in Machine Shop.



View of the Brass Department, situated on the gallery of the Machine Shop.

# N.T.R. Boiler and Tank Work Departments at Transcona

*Steel plate work enters so largely into the construction of the modern locomotive that an equally effective layout and equipment to that of the locomotive machine and erecting shops becomes a necessity. From the illustrations and detail data forming this article, it will be noted that ample provision has been made.*

THE boiler and tank shop is one of the finest in the plant, and is situated at the east end of, and at right angles to, the locomotive shop, as may be seen from the plan on page 194. The shop is 180 feet long by 205 feet wide, and the height to the roof trusses is 36 feet. It is divided into four bays having widths of 65 feet, 30 feet, 50 feet and 60 feet respectively. The east bay (65 ft.) forms the tender tank repair shop and is served by a 20-ton Booth electric traveling crane. There are nine transverse tracks; tenders entering the shop by the second from the south, which is a through track to the riveting tower. The two tracks at the north end of the shop are used for truck work, thus leaving six tracks for tank repairs. Between each two adjacent tracks is a work bench with two vises, similar in every respect to those in the locomotive shop.

Boiler Shop Petty Stores. Stairs leading to gallery, where are located the toilet and locker rooms.

At the end of the two north tracks are located a 200-ton hydraulic car wheel press (165) and a 45-inch Bridgeford gap lathe (159) for refinishing truck axle journals without removing the wheels. This lathe is placed in a pit, bringing the gap on a level with the shop floor, so that any axle requiring to have its journals re-turned can be run on its wheels right into the lathe, a pneumatic jack being thereafter used to adjust it in the centres. The arrangement is clearly seen in the cut on this page. The lathe can also be used as a single end axle lathe; the head being moved along the bed by a rack and pinion so as to bring the wheel fit on the axle within the range of the carriage.

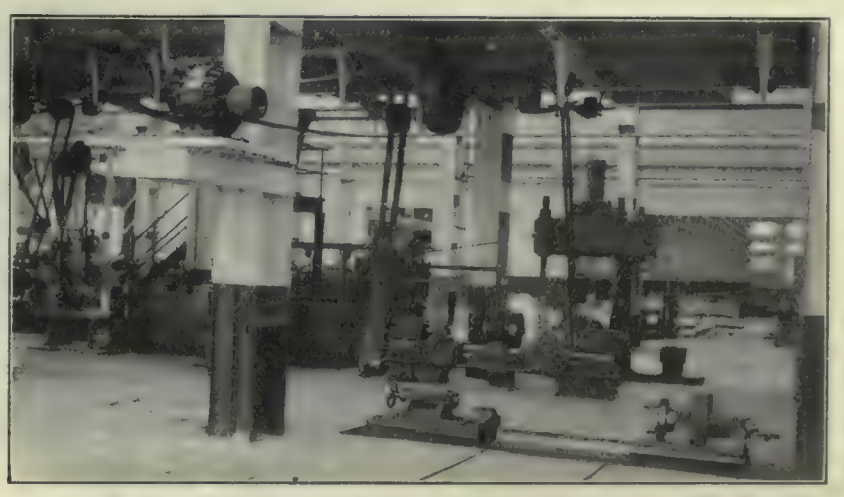
### The 30 Ft. Bay.

The 30 ft. bay contains the machine tools for tender truck wheel, axle, and axle box work; the tools being divided into two groups and located under a gallery which extends rather more than half the length of the bay from the north end. This gallery is 20 feet above the shop floor level and carries the lavatory and locker rooms together with the Sturtevant heating apparatus; the shop being heated on the same system as the locomotive shop. A 5-ton electric traveling crane serves that part of the bay not covered by the gallery.

At the south end is situated the compressor room, which houses the Bellis and Morcom motor-driven air compressor referred to in the description of the locomotive erecting shop. The foreman's office is above the compressor room and is exceptionally large and well lighted; windows on all sides giving a clear view of every part of the shop. The line shafts and millwright work in this department are exactly the same as in the locomotive shop, but the machines under the gallery are served by an industrial track instead of by shop floor trucks.

### 30 Ft. Bay Machine Equipment.

The truck axle boxes are bored out on a Bertram double spindle car box boring machine, having double carriages (165A). This is driven by a 10 h.p. variable speed motor and will bore four pairs at one operation. Next to this machine is a 42-inch coach wheel lathe (164) by the Canada Machinery Corporation; the chief feature of which is a central drive by means of steel pinions engaging with coarse internal gears behind the face plates. This lathe is fitted with pneumatic tool clamps similar to those on the heavy driving wheel lathe (120) in the locomotive machine shop. It is driven by a 40 h.p. variable speed Canadian-Westinghouse motor having a speed variation of 3 to 7, while the heads are moved in and out by two 3 h.p. alternating current motors operating through a reversing switch. A lathe of this type was fully described in Canadian Machinery in June, 1911.



View in Boiler and Tank Shop. Here is seen the Bridgeford gap lathe set in a pit, so that truck wheels and axles may be rolled in from the track in the foreground.

Dealing next with the tools below the gallery, group 12 is driven by a 30 h.p. motor and contains the following tools:

double axle lathe with central drive (149); 12-inch slotter (155); 45-inch gap lathe (159); 24-inch drill press (157); small punch (154); and 48-inch radial drill (153). Group 13 is driven by a 40 h.p. motor and consists of 6 feet bending rolls (145); double emery grinder (156); single axle lathe (150); two 42 in. car wheel boring machines (160 and 161); and one double spindle drill

View looking south below Boiler Shop gallery. On the right is seen the double axle lathe by Pollock & McNab.

(180). Beside the 48 in. radial drill (153), there is a pit to accomodate any work that would otherwise be too high for the tool.

### The 50 Ft. Bay.

The 50 ft. bay is served by a 10-ton traveler, which like all the others in this shop was built by J. Booth & Bros. Ltd. It is occupied by the flanging press and furnaces, the large plate rolls and the heavy machinery generally. A standard gauge track runs down this bay with turntable connection to the through track. At the north end there is an angle iron forge and beside it an open forge, both supplied by F. Hyde & Co. Blast at 10 oz. pressure is supplied by a Canadian Buffalo Forge Co.'s No. 5 blower, seen on the plan against the north wall and beside the angle iron forge. It is belt driven from the line shaft in the 30 ft. bay.

Flanging is done on a 560-ton, 4 column, hydraulic press having 11 ft. 6 in. clearance. This is numbered 168 on the plan, page 194, and as may be seen, stands out so far towards the centre of the bay as to prevent the latter from being served by the standard gauge track throughout its full length. This, however was unavoidable, the foundations of the adjacent column rendering it imposible to set the flanging press further to the west. The press is by R. D. Wood & Co., who also built the accumulator for it. The latter has a ram 15 inches in diameter and a stroke of 15 feet. Besides serving the boiler shop it operates the boiler riveter and the hydraulic machines in the forge shop. It is served by two Gould 3 in. x 8 in. triplex pumps, driven by 40 h.p. Westinghouse A.C. motors. The working pressure is 2,000 pounds per square inch. The flanging press is served by a 12 ft. x 8 ft. fuel oil furnace situated about 15 feet to the north of it. There is a similar furnace for annealing purposes to the south of the press. Both are seen in the cut on page 201. They were manufactured by F. Hyde & Co., and, in common with the numerous other oil furnaces throughout the plant, are fitted with Jacob's low pressure burners, using fan blast pressure. The furnaces are lined with best quality Harbison-Walker refractory material, and are well designed in every way. The doors are operated by vertical pneumatic cylinders. Blast is provided by a Canadian Buffalo Forge Co., No. 12 steel pressure blower of the three-quarter housing type, with down discharge, connecting to the underground distributing pipe, which is placed 13 inches below the floor level. From the outlet of the blower, a large sweep elbow is thus allowed. The large blast pipe, increasing from 18 to 24 inches diameter, not only provides for future extension in case it is found necessary but also reduces the friction which is inevitably incurred wherever it is attempted to force air through piping at a high velocity. This blower is designed to deliver 10,000 cubic feet of air per minute, at a pressure of 16 oz. when running at 1,750 r.p.m., and is direct connected with flexible coupling to a 75 h.p. Allis-Chalmers-Bullock Co. motor.

A further special feature is the construction of blowers of this type for delivery of air at such a high pressure as 16 oz., and with a speed so low as 1,750 r.p.m. The desired results are secured by the use of a special narrow housing, with blast wheel of large diameter, and having a larger number of blades than in the ordinary design.

### 50 Ft. Bay Machine Equipment.

Of the machines in this bay the largest is No. 166,—the Bertram heavy plate bending rolls. These have a capacity for plates 14 feet wide and 7-8 inch thick. The upper roll is 24 inches diameter, and the lower rolls are 18 inches. The latter are driven by a 40 h.p. motor, and the upper roll is adjusted by worm gearing operated by an independent 12 h.p. motor. Plates are planed on a 24 feet plate edge planer (158), which is belt driven from the line shaft in the 30 feet bay and really forms part of group 13. This planer is fitted with hydraulic clamps in addition to the usual hand screw clamps. There

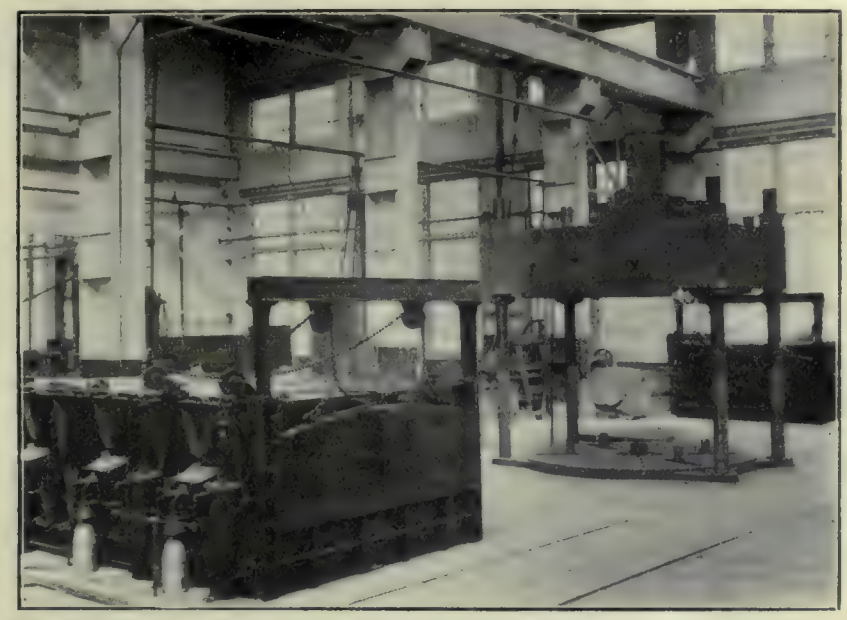
Bertram heavy motor-driven plate-bending rolls in Boiler Shop. Upper roll 24-in. diam. Lower rolls 18-in. diam. Distance between housings 14 ft. 2in. Motor 40 H.P.

is a Lennox rotary bevel shear (173A) for bevelling the edges of boiler plates that have to be caulked. This machine is driven by a 7½ h.p. motor. The only other motor driven tool in this bay, in addition to the heavy rolls (166) already mentioned, is (163) a single ended

punch or shear (convertible). It has a 36-inch throat and is driven by a 10 h.p. induction motor.

The belt driven tools in the 50-ft. bay form group 11 and are driven from a line shaft on the west side. The tools included in this group are numbered 78A, 146, 147, 148, and 151. Staybolts are threaded on 78A, which is a Lassiter 6-spindle staybolt machine. Right beside it is a small Foote-Burt 4-spindle drill (151) on which the tell-tale holes are drilled. Mud-rings are drilled on a Webster & Bennett 4-spindle drill (146), provided with pit, pump, etc. Further equipment in the boiler shop includes a pneumatic staybolt nipper and pneumatic staybolt breaker.

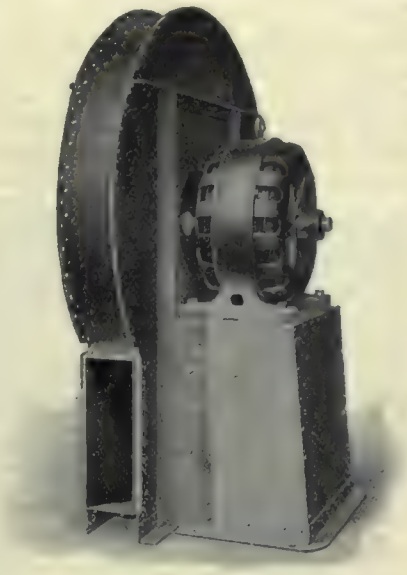
In laying out this shop, great care was taken to ensure that no machine when working on large plates, etc., shall interfere with the operation of neighboring machines.



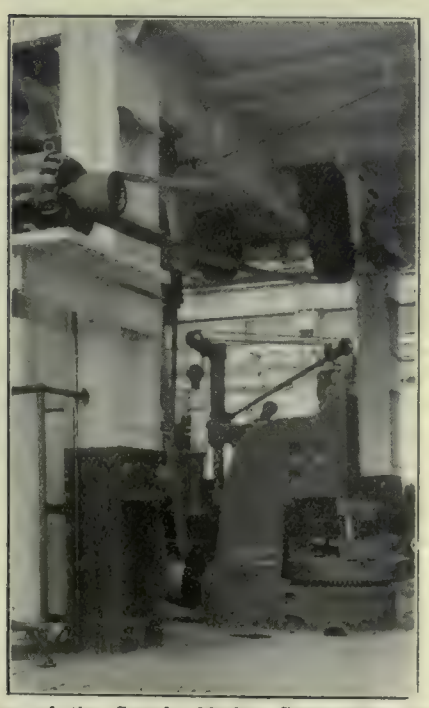
A corner of Boiler Shop, showing 560-ton Hydraulic Flanging Press and Oil Furnaces. The Press is served by the Furnace in the Background.

### The 60-Foot Bay.

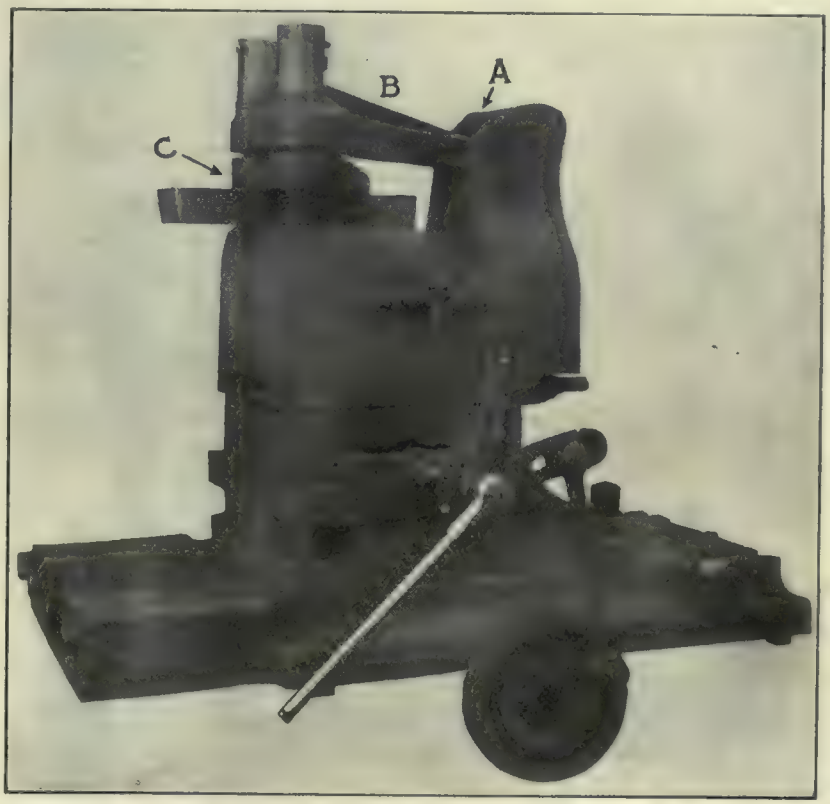
Boiler assembling is done in the 60-foot bay, which is that next to the locomotive shop wall. This bay is served by a 30-ton electric traveling crane and by a standard gauge track down the east side. After being assembled, boilers are carried by the traveler to a truck on the through track at the south end of the shop, and run to the riveting tower. This, as previously mentioned, is situated at the east end of the 40-foot bay of the machine shop. The hydraulic riveter (178) has a gap of 18 feet 6 inches, enabling the largest boilers to be riveted up without turning over. This machine is believed to be the largest of its kind in Canada at the present time, and weighs 112,000 lbs.



Canadian Buffalo Forge Co.'s No. 12 Steel Pressure Blower.



One of the Canada Machy. Corporation 42-inch car wheel boring machines in Boiler and Tank Shop. It is equipped with a pneumatic hoist.




Pneumatic tool clamp fitted in Canada Machinery Corporation 90-inch driving wheel lathe, and 42-inch coach-wheel lathe.

It was built by R. D. Wood & Co., Philadelphia, and is of the triple power outside packed type of 50, 100 and 150 tons capacity. A 20-ton electric crane serves the riveter, and is entirely controlled from the riveting platform, which is of sufficient size to give ample room for the operators, rivet furnace, etc.

The boiler shop is fully equipped with complete sets of staybolt taps, reamers, etc., manufactured by A. B. Jardine & Co., Hespeler, Ont., while the numerous pneumatic tools in this and the locomotive shop were supplied by the Holden Co., Ltd., Montreal, and include Little Giant tube expanders and air drills; New Boyer holders-on, riveting and chipping hammers; and a Chicago 12-inch spread jaw pneumatic riveter. There is also full provision of sledge hammers, wrenches, ratchet drills, oil burners and necessary general equipment. The 50-foot bay is provided with two 6 feet by 9 feet surface blocks, shown on the plan, but not numbered.

The hydraulic accumulator (169) stands at the north end of the 60-foot bay, and the two pumps (171 and 172), which, of course, are automatically controlled, stand close by. All hydraulic machines exhaust back to the tank, so that the same water is in use all the time. In front of the accumulator is a pit over which the finished boilers are placed when receiving their hydraulic and steam test, before passing to the erecting shop.

The table on this page gives particulars of the machine tool equipment.

The cranes in this shop all have a maximum traveling speed of 250 feet per minute, with the exception of the 20-ton crane in the tank department, which has a speed of 200 feet. The racking speed is 100 feet per minute in every case, and except in the case of the 5-ton crane serving the south end of the 30-foot bay, each crane has two hoisting speeds.

The floor is of 3-inch planking, spiked to timbers set in bituminous concrete, similar in every way to that in the locomotive shop.

**BOILER AND TANK SHOP EQUIPMENT.**

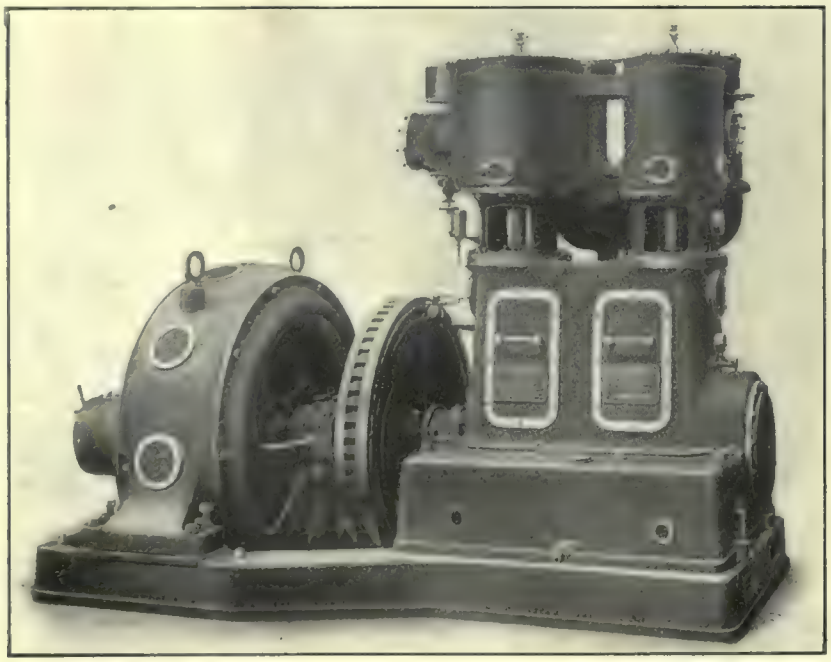
| No. of Machine. | Class of Machine. | Size. | Maker. | Motor. |
|---|---|---|---|---|
| 143 | Hand rolls | 6″ | Bertram | |
| 144 | Flange clamp | 8′ | Wickes Bros. | |
| 162 | Single end punch or shear (convertible) | 36″ throat | Bertram | 10 A.C. |
| 164 | Coach wheel lathe | 42″ | Can. Machy. Corporation | 40 D.C. |
| 165A | Car box borer | Double spindle | Bertram | 10 D.C. |
| 156 | Double grinder | 20″ | Norton | Group |
| 160 | Car wheel borer | 42″ | Can. Machy. Corporation | Group |
| 161 | Car wheel borer | 42″ | Can. Machy. Corporation | Group |
| 155 | Slotter | 12″ | Can. Machy. Corporation | Group |
| 159 | Gap lathe | 45″ | Bridgeford | Group |
| 157 | Vertical drill | 24″ | Robertson | Group |
| 165 | Hydr. wheel press | 200 ton | R. D. Wood | Group |
| 170 | Flange clamp | 12′ | J. H. Optenberg | |
| 154 | Punch | 12″ throat | Bertram | Group |
| 153 | Radial drill | 48″ | Bertram | Group |
| 149 | Double axle lathe (with crane) | 12″ | Pollock & McNab | Group |
| 180 | Double spindle drill | 24″ | Foote-Burt | Group |
| 150 | Single axle lathe (two carriages) | 14″ | Bertram | Group |
| 145 | Bending rolls | 7′ | Bertram | Group |
| 158 | Plate edge planer | 26′ | Jas. Bennie & Sons | Group |
| 163 | Horiz. hydraulic punch | 61″ throat | R. D. Wood | |
| 151 | Staybolt drill | 4 spindle | Foote-Burt | Group |
| 78A | Lassiter staybolt machine | 6 spindle | Walter H. Foster | Group |
| 146 | Mudring drill | 4 spindle | Webster & Bennett | Group |
| 173A | Rotary bevel shear | | Lennox | 7½ A.C. |
| 166 | Heavy bending rolls | 14′ | Bertram | 40 D.C. |
| 147 | Double end punch and shear | 24″ throat | Craig & Donald | Group |
| 148 | Emery grinder | 20″ | Prescott Emery Wh'l Co. | Group |
| 167 | Wall radial drill | 18′ | F. Pratt & Co. | 5 D.C. |
| 168 | Hydraulic accumulator | 15″x15′ | R. D. Wood | |
| 171 | Triplex force pump | 3″x8″ | Gould Mfg. Co. | 40 A.C. |
| 172 | Triplex force pump | 3″x8″ | Gould Mfg. Co. | 40 A.C. |

# The Forge Shop, Forge Stores, and Scrap Bins

*This department is centrally located in order that it may conveniently serve both locomotive and car departments. The lay-out is good, the location of the jib cranes, hammers and furnaces having been given very careful consideration.*

THE forge shop is 260 feet long by 100 feet wide, and is spanned by a single truss roof, as dictated by the best modern practice. The elimination of intermediate supporting columns allows free scope in the distribution of equipment and facilitates the placing of the swinging jib cranes in the most suitable positions for serving the hammers and furnaces. This shop is well lighted by side and end windows, the upper panels of which are pivoted to give ventilation. The lower sashes can also be raised in summer, and further light and ventilation is afforded by the monitor, which extends the full length of the roof. The shop has a floor of wall-tamped cinders, and is heated by direct radiation, the steam coils being arranged along the walls below the windows. There being no overhead cranes, the wall columns of this building are of lighter construction than in the locomotive shop, since they have only the roof truss loads to carry. The building is very rigidly tied by struts and lateral bracing to counteract vibration caused by the steam hammers and the stresses set up by the jib crane loads.

As may be seen from the view on page 188, the forge shop lies immediately to the north of the locomotive shop, being situated between it and the



One of the three Belliss & Morcom two-stage, motor-driven air compressors.

eventual position of the car machine shop. It is thus able to conveniently serve both departments. The floor is well covered by industrial tracks, with turntables at each intersection, and the layout of the equipment is seen in the plan on page 204. The end of the building facing on the midway is to the left or west side. A small two-storey annex on the south accommodates the toilet and locker rooms.

### Spring Dept.

The south-west corner of the shop is devoted to making and repairing locomotive and car springs. The furnaces in this department, and throughout the shop, all burn fuel oil and were manufactured by F. Hyde & Co., Montreal. They are fitted with low pressure burners similar to those in the boiler shop. The blower for the spring department is designed to deliver 4,800 cubic feet of air per minute at 14 oz. pressure when running at 1,750 R.P.M. It is a Canadian Buffalo Forge Co.'s No. 7 special steel plate blower, direct connected to a 40 H.P. Allis-Chalmers-Bullock A.C. motor. The spring furnace is equipped with the usual oil-quenching baths, racks, etc., and every convenience is at hand for turning out springs rapidly and economically. A full list of the equipment is given on page 205, the machine numbers corresponding with those on the plan on page 204.

### Hand Forges.

The south side of the shop, east of the spring department, is occupied by a row of thirteen double forges, by F. Hyde & Co. These are spaced 15 feet apart on a centre line 16 feet 9 inches from the wall, and, as may be seen, are set at an angle to facilitate the handling of long stock. Such an arrangement results in a very considerable saving of floor space, and of course reduces the necessary stacks and holes in the roof by one-half. Each forge is fitted with an automatic valve, by means of which the gases generated when the fire is damped down can escape freely to the atmosphere. Where no such provision is made, the gases accumulate in the blast pipe and are liable to cause an explosion in the latter when the fire is rebuilt. In order to obtain an even temperature, running water is piped to the cooling tanks attached to each forge, the overflow being carried to sewer. Each forge is well equipped with the necessary tool racks, etc., and has a 400-lb. anvil.

The frame forge is seen on the plan, just south of the industrial track turntable in the centre of the shop. It is of the drop type, operated by a pneumatic jack. When the locomotive frame is being heated the forge is in its elevated position; but when the correct heat has been attained, the forge is dropped and the frame swings away, without the necessity of raising the cranes. This is a great improvement upon the usual method, which involves more or less dragging of the frame through the coal on the forge, thus getting dirt in the weld.

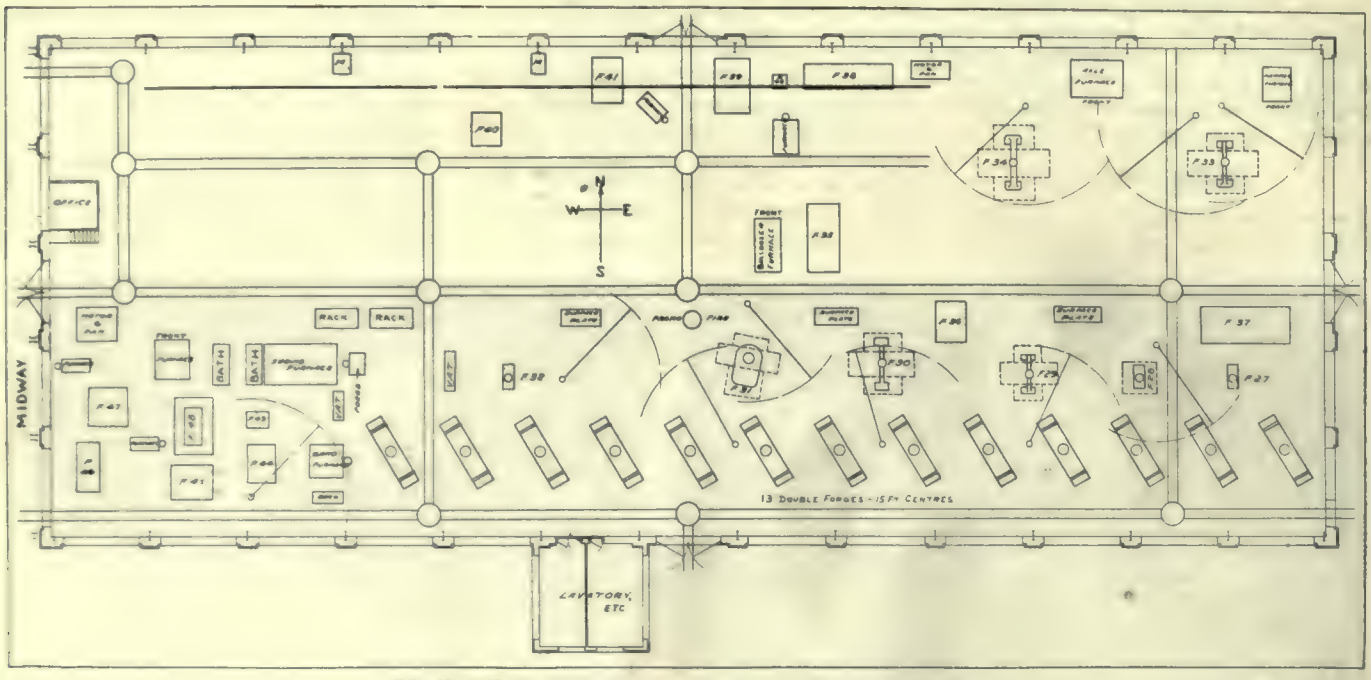
SOUTH SIDE OF FORGE SHOP, SHOWING SPRING DEPARTMENT.

### Hammers, Cranes, Etc.

In front of the row of double forges there are six hammers, varying from 200 lbs. to 3,500 lbs. The frame hammer (F31) is of the latter weight, and is set at an angle best suited to serve the frame fire. The jib cranes were all supplied by Geo. Anderson & Co., Ltd., Montreal; their location is indicated on the plan. In addition to the necessary surface plates, etc., this part of the shop

is equipped with a vertical hydraulic bar shear (F36) and an alligator shear (F37) direct driven by a 25 H.P. motor. In the northeast corner are two hammers and furnaces for the heavier work. One of these (F33) is 3,500 lbs., and the other (F34) is 5,000 lbs. The John Bertram & Sons Co., Ltd., built all the hammers with the exception of that marked F32; this is a 200-lb. single frame hammer by Thwaites Bros., Ltd., Bradford, Eng. It was found necessary, owing to the nature of the ground, to pile all the hammer foundations. To accommodate the steam, exhaust, hydraulic, water and fuel oil lines, there is a concrete duct running up the middle of the shop from the midway tunnel and powerhouse. Branches connect with the hammers, furnaces, hydraulic shears, etc.

In the centre of the shop is a powerful hydraulic bulldozer (F35) with oil furnace adjacent. Along the north side of the shop are ranged the forging machines and a heavy axle cutting-off and centering machine (F38). The latter




PLAN AND EQUIPMENT LAYOUT OF FORGE SHOP.

North side of Forge Shop. This shop serves Locomotive and Car Depts. As may be seen, ample space has been provided for further equipment when the Car Shops are completed. The machine in the foreground is a hydraulic bar shear by R. D. Woods & Co.

is fitted with two heads and carriages, and centering attachment; its capacity being 12 inches diameter by 14 feet. These machines are driven from line shafting divided into two groups, each driven by a 40 H.P. motor. The shaft at the west end is at present idle, having been provided to drive further equipment, which will probably be installed in the forge shop when the car shops are completed. The manner in which the line shafts are carried from the roof trusses, and the countershafts from light lattice girders bolted to the wall columns, is clearly seen in the illustration at foot of page 204. The shafting equipment here is the same as in the other shops, viz: 2 15-16 inch shafting, 24-inch hangers and Chapman double ball bearings.

There are three blast fans, each direct motor driven. That in the spring department has already been described. The other two are of the same style and make. One is a No. 12 blower exactly similar to that in the boiler shop, and the other is a No. 8 blower, designed to deliver 6,400 cubic feet of air per minute at 14 oz. pressure. It is coupled to a 50 H.P. Allis-Chalmers-Bullock Co. motor and runs at 1,750 R.P.M.

### Forge Stores and Scrap Bins.

Behind the forge shop are the forge stores and scrap bins. The general style of this building may be gathered from page 188, where it is numbered 11. It is a wooden frame structure 220 feet long by 30 feet wide. The eastern half consists of a raised platform, roofed in and divided into suitable bins for the reception of the various grades of scrap. The other half forms a store for the rods, bars, etc., used in the forge and also for the coal and coke. For the former there is an extensive system of stout racks, while the latter are stored in bins. Hatches are fitted in the roof above these so that the yard crane may unload cars direct into the bins by means of an orange peel bucket. The store is served by a continuation of the industrial track system from the forge shop, so arranged as to reduce to a minimum the amount of handling necessary in transferring stock from the iron rack to the forge.

**SPRING DEPARTMENT EQUIPMENT.**

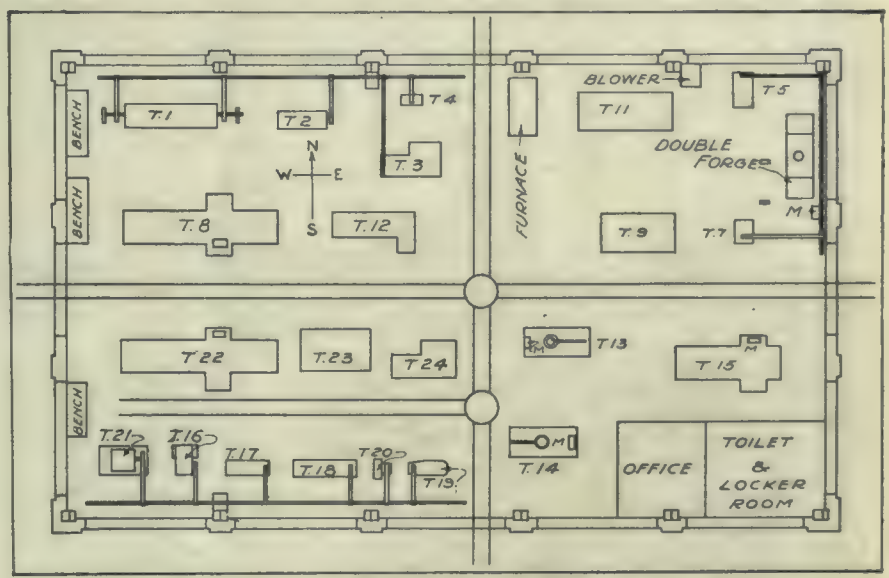
| No. of Machine. | Class of Machine. | Maker. |
|---|---|---|
| F43 | Spring tester | R. D. Wood |
| F44 | Hydraulic spring bander | R. D. Wood |
| F45 | Hydraulic punch | R. D. Wood |
| F46 | Hydraulic band remover | R. D. Wood |
| F47 | Combined nibber & trimmer (7½ H.P. motor driven) | J. Evans' Sons |
| F48 | Tapering rolls (10 H.P. motor driven) | J. Evans' Sons |
| | **HAMMERS.** | |
| F27 | 200-lb. single frame hammer | Bertram |
| F28 | 1250-lb. single frame hammer | Bertram |
| F29 | 1500-lb. double frame hammer | Bertram |
| F30 | 3000-lb. double frame hammer | Bertram |
| F31 | 3500-lb. single frame hammer | Bertram |
| F32 | 200-lb. single frame hammer | Thwaites Bros. |
| F33 | 3500-lb. double frame hammer | Bertram |
| F34 | 5000-lb. double frame hammer | Bertram |
| | **FORGING MACHINES, SHEARS, ETC.** | |
| F35 | Hydraulic bulldozer | R. D. Wood |
| F36 | Vertical hydraulic shear | R. D. Wood |
| F37 | Alligator shear (25 H.P. motor driven) | Wickes Bros. |
| F38 | Axle centering and cutting-off machine | Bertram |
| F39 | 3½-in. forging machine | Acme Mach. Co. |
| F40 | Hydraulic bar shear | R. D. Wood |
| F41 | 1½-inch bolt machine | Acme Mach. Co. |
| F42 | Double emery grinder | Norton |

# The Frog and Track Shop and Crude Oil Storage

*Not the least important department in a modern railroad headquarters plant is that devoted to the maintenance and repair of frogs, switches and track work generally. The Transcona frog shop is not designed for turning out new work; a comparatively small building is consequently sufficient to accommodate the various machine tools used in this class of track work.*

THE frog and track shop, number 9 on page 188, stands about 250 feet east of the forge shop. The nature of the work done here calls for no interchange with other departments, hence, there is no necessity for a location on the midway, the shop being an entirely self-contained unit. It is 100 feet long by 60 feet wide and has a height of 24 feet to the lower chord of the roof trusses. It is spanned by a 10-ton Booth electric traveling crane, having the following speeds per minute: traveling, 200 feet; racking, 100 feet; hoisting, 15 feet and 40 feet. The shop has the usual 3-inch wood floor, and is served by industrial tracks. A standard gauge track will doubtless be brought into the shop at some future date to enable the finished frogs and switches to be loaded by the traveler direct onto flat cars. Ample natural lighting is provided by large window and skylight areas, while artificial illumination is by mercury-vapor lamps, as in the other shops.

Owing to the nature of the work turned out, no great head room is required in a frog shop; and in the present instance, the height to the roof truss chords, as above mentioned, is only 24 feet; the crane runways being correspondingly lower. The limited headroom available has necessitated carrying the line shafts about 4 feet above the floor, the drive being upwards to countershafts above. In this way only could sufficient length of drive be obtained for all belts. The main line shafts run in Chapman double ball bearing pillow blocks, supported on gusset brackets. The latter are riveted to a light lattice girder carried by the wall columns the arrangement being similar to that employed in the forge shop. The countershafts, as may be clearly seen in the illustration, are carried by brackets from the crane runway girders; the crane operator's cage being brought out to clear them. The foreman's office and the locker rooms, etc., are in the southeast corner of the shop, and are enclosed by a wall 8 feet high only, to




LAYOUT OF FROG AND TRACK SHOP.

allow the crane to pass overhead. The office has a light roof, but the lavatory is open. The building is heated by direct radiation; the steam coils being arranged along the walls below the windows.

In the north east corner there is a double forge similar in every way to those in the forge shop. This forge is served by two belt driven strap hammers (T5 and T7) of 200 lb. and 125 lb. weight respectively. These will handle all the blacksmith work in the shop. The planers and other heavy machines have individual motor drives and occupy the body of the shop; while the lighter tools are arranged along the north and south walls and driven from line shafts. The accompanying table gives particulars of the equipment.

The bulldozer (T11) is served by an oil furnace supplied by F. Hyde & Co., and is equipped with jib crane, as are also the two strap hammers. Blast is obtained for the forges and oil furnace from a Canadian Buffalo Forge Co.'s No. 5 steel plate blower. This is direct connected to a 25 h.p. motor, running at 1750 r.p.m., and has a duty of 2,700 cubic feet of air per minute at 14 oz. pressure.

### Crude Oil Storage.

Crude oil is stored in a concrete building close beside the north side of the frog shop. To avoid risk of fire, the building is sunk in the ground nearly its entire depth, the walls only projecting some two feet above ground level. Its inside measurements are 60 feet long, 25 feet wide and 10 feet deep. The roof is of concrete supported by steel beams. Inside are four horizontal cylindrical steel tanks, each having a capacity of 8,000 gallons. They are fitted with large pipe necks extending to the outside of the building by means of which they are filled from tank cars on the adjacent track.

Pumps are not used for distributing the oil to the various shops; instead, compressed air is piped to each storage tank and the oil is thus forced all over the system. The air connection to any tank can of course be cut off to allow of filling.

This system probably makes for cheaper distribution than would be the case if pumps were used, but would seem to present greater risks of breakdown. If anything goes wrong with the air supply, the whole plant is deprived of oil; whereas with pumps each shop may be made a separate self-contained unit.

**FROG AND TRACK SHOP EQUIPMENT.**

| No. of Machine. | Class of Machine. | Size. | Maker. | Motor. |
|---|---|---|---|---|
| T1 | Double travelling head shaper | 18" | F. Pratt & Co. | Group |
| T2 | Railway frog slotter | 12" | Bertram | Group |
| T3 | Cold cut-off saw | | Q. & C. | Group |
| T4 | Double emery grinder | 14" | Norton | Group |
| T8 | Frog and switch planer | 36"x36"x12' | Bertram | 25 A.C. |
| T12 | Rail bender | 100-lb. rails | Long & Allstater | 10 A.C. |
| T11 | Bulldozer | No. 0 | Ajax | 15 A.C. |
| T9 | Punch and shears | 25" throat | Wickes Bros. | 3 A.C. |
| T5 | Strap hammer | 200 lbs. | Fairbanks | Group |
| T7 | Strap hammer | 125 lbs. | Fairbanks | Group |
| T15 | High speed planer | 36"x36"x8' | Bateman | 15 A.C. |
| T13 | Radial drill | 36" | Can. Machy. Corp. | 3 A.C. |
| T14 | Radial drill | 36" | Can. Machy. Corp. | 3 A.C. |
| T22 | Planer with side head | 36"x36"x12' | Bertram | 10 A.C. |
| T23 | Rail drill | 3 spindle | Bertram | 10 A.C. |
| T24 | Cut-off saw | | Q. & C. | 5 A.C. |
| T21 | Horizontal milling machine | 28"x9"x19" | Alfred Herbert | Group |
| T16 | Shaper | 16" | Potter & Johnston | Group |
| T17 | Bolt lathe | 14" | R. McDougall Co. | Group |
| T18 | Engine lathe with taper attachment | 18"x10' | R. McDougall Co. | Group |
| T20 | Grindstone | 36"x6" | Cleveland Stone Co. | Group |
| T19 | Vertical drill | 24" | W. F. & J. Barnes | Group |

INTERIOR OF FROG AND TRACK SHOP.

# Central Power House Equipment, N.T.R. Shops, Transcona

*The growing appreciation of the paramount importance of having a thoroughly efficient and reliable power plant equipment form an integral part of every type and extent of manufacturing effort is amply demonstrated in the subject matter of this article. It is here shown that requirements have been wisely and carefully forecasted, and as a result, perusal of the details forms an attractive and educative exercise for every class of our readers.*

THE power house, like the other principal buildings, is a self-supporting steel structure, with walls of concrete as far as the window sills, from which point up they are of white brick. The building is 150 feet long by 110 feet wide, and is divided longitudinally by a brick fire wall into two parts 45 feet and 60 feet wide. The smaller part forms the boiler house, and the larger the engine room. The boiler house contains eight water tube boilers, by the John Inglis Co., Ltd., Toronto. They are of the Erie City vertical tube type, and are rated at 425 H.P. each. The working pressure is 150 lbs. There are four groups of two boilers each, three of the groups being fitted with automatic chain grate stokers operated by small vertical engines in the basement. The grate equipment was supplied by the Illinois Stoker Co., Alton, Ill. The fourth group is hand fired, and when the planing mill is completed and in operation, will consume all shavings, sawdust and scrap lumber.

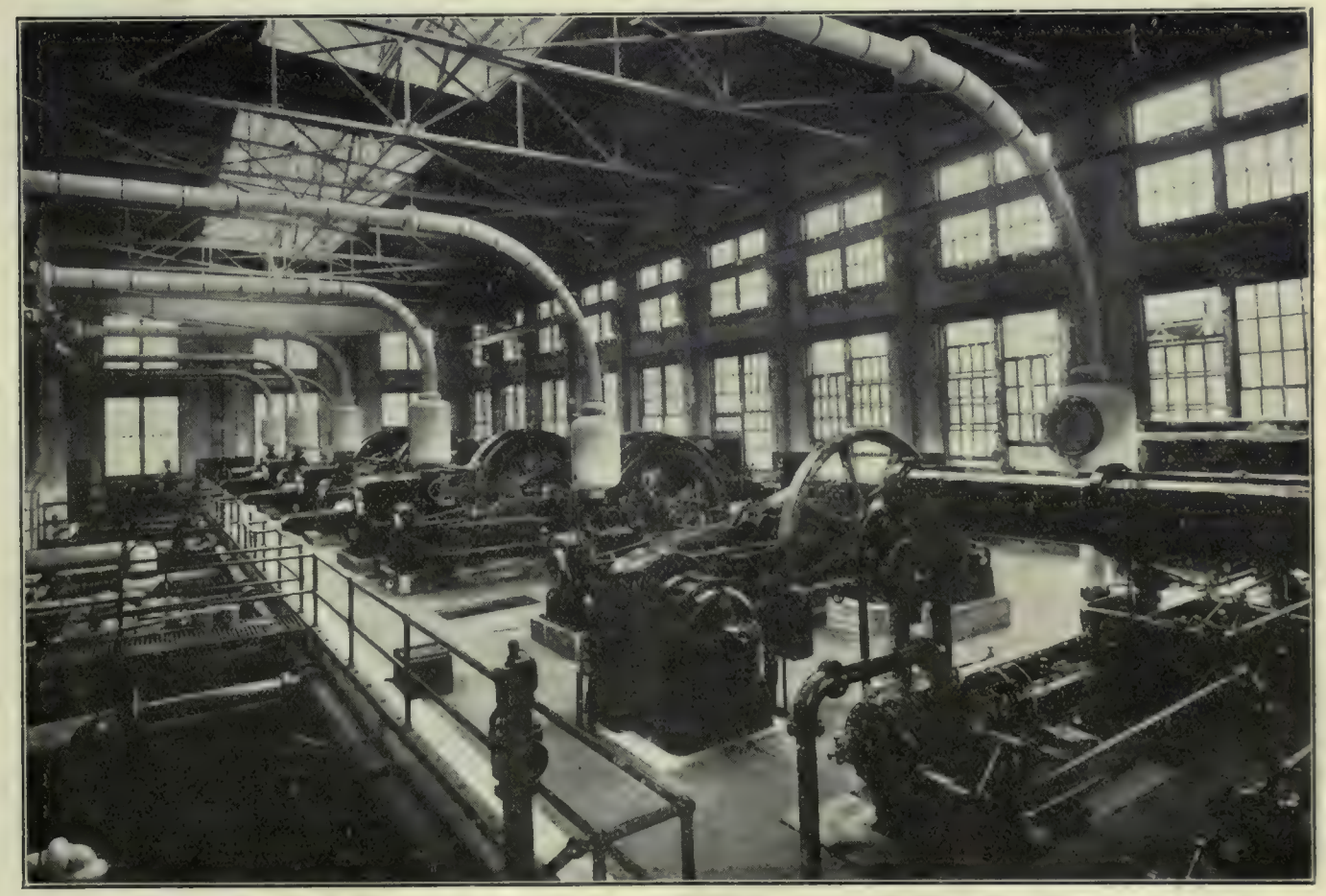
The boilers all blow off into a common blow-off main leading to a well situated outside the building and connected to sewer.

### Chimney.

The products of combustion from all the furnaces pass into a steel breeching running overhead in a passage way between the back of the boilers and the fire wall previously mentioned. Natural draft is provided by a Weber reinforced concrete chimney, 210 feet high above ground level, by 11 feet internal diameter. The breeching enters the chimney about 12 feet above ground level by an opening 15 x 6 feet. The chimney has two 24 x 18 inch cleaning doors at the bottom, and stands upon a concrete footing 30 feet square at the base by 11 feet deep. This footing rests upon eighty-four wooden piles, 25 feet long.

### Coal and Ash Handling Equipment.

The automatic system of handling coal and ash is very complete, and the labor necessary in the boiler house is reduced to a minimum. Coal is brought in from the west end of the yards in hopper cars, which are weighed on track scales before reaching the power house. The cars then proceed on a track adjacent to the boiler house and ascend a ramp elevated 7 feet above grade level. The coal is here dumped into a steel receiving bunker, from whence it is taken by a belt conveyor to the crusher, situated



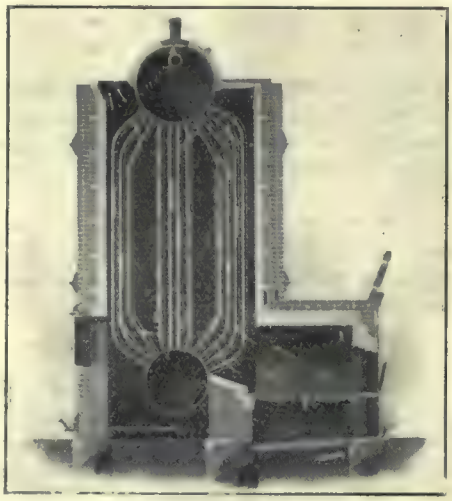
Interior of Power House looking west. In the foreground are seen the Inglis Air Compressor and the Motor-Generator Set.

in the boiler house basement. The crusher is driven by a 20 H.P. motor. The coal next passes to an endless chain bucket conveyor, driven by a 10 H.P. motor; and is carried to the overhead bins, of which there is one for each boiler. These bins are lined with fibricated asphalt supplied by the Interior Construction Co., Winnipeg. This consists of a mixture of asphalt, asbestos and sand, and it is expected to turn out an improvement on the usual concrete lining, which wears so rapidly under the weight and friction of the coal. From the overhead bins the coal descends by chutes to the stoker hoppers, so that from the time it is dumped from the cars to the time it reaches the grates it is handled entirely by automatic means.

The endless chain conveyor is also used for ash removal. Its horizontal run is, of course, in the basement, so that the ashes are merely raked out from the ash pits and discharge themselves through chutes to the conveyor, which elevates them in the same way as it does the coal, but is now tripped to deliver the ashes to a special concrete-lined ash hopper located overhead alongside the coal bins. From here the ashes pass by steel chutes to the cars outside, so that the same car which delivers coal may be used for removing ash, thus saving switching. The coal crusher and conveying apparatus was installed by the Jeffrey Manufacturing Co., Ltd., Montreal, and is of their latest type.

### The Engine Room.

As above mentioned, the engine room is 150 feet long by 60 feet wide, the head room to the underside of the steel roof trusses being 30 feet. The walls for a height of 6 feet from the floor are finished with a coat of black paint; above this height they are whitewashed. The floor consists of standard maple flooring laid on top of a rough lumber under-floor, which in turn is laid on 4 x 6 inch timbers bedded in bituminous concrete. Ample lighting is secured by windows in the side and end walls, and by central skylights in the roof. The engine room is served by a



SECTION SHOWING CONSTRUCTION OF ERIE CITY VERTICAL WATER TUBE BOILER.

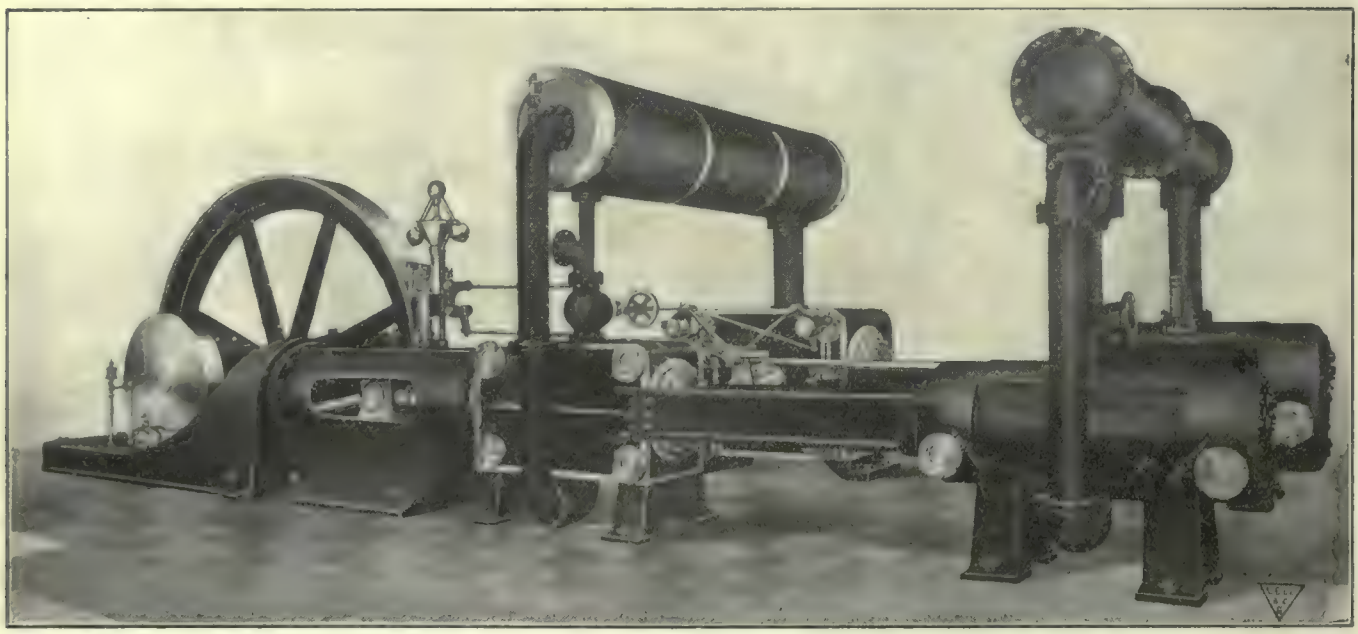
hand-operated 10-ton travelling crane supplied by Geo. Anderson & Co., Ltd., Montreal.

All the generators are by the Canadian General Electric Co., and all the engines are by the Goldie & McCulloch Co., the nominal capacity of the plant being 2,050 kilowatts. There are three main units, each consisting of a cross-compound Corliss engine direct connected to a 3-phase generator of 500 K.W. capacity. These three engines have cylinders 21 and 34 inches in diameter by 30 inches stroke, and run at 150 R.P.M. A fourth A.C. unit consists of a 250 K.W. generator driven direct by an 18 x 30-inch simple Corliss engine running at 150 R.P.M. All alternating current is 3-phase, and is generated at 600 volts, 60 cycles.

Duplicate exciter units for the four A.C. generators are located at the west end of the engine room, and consist of two Ideal high-speed engines (11 x 12-inch), running at 275 R.P.M., and direct coupled to continuous current, 125 volt generators of 65 K.W. capacity each. To supply current for the variable speed motors driving many of the larger machine tools there are two D.C. units. One of these consists of a 14 x 30-inch simple Corliss engine running at 150 R.P.M., direct connected to a continuous current generator of 150 K.W. capacity. The second unit is a motor generator set; a 225 H.P. induction motor takes current from the A.C. bus bar, and drives the generator at 900 R.P.M. The capacity of both units is the same —150 K.W., the current being generated at 250 volts.

At the east end of the engine room is installed the main air compressor unit. This was supplied by the John Inglis Co., and is a horizontal cross compound Corliss two-stage compressor, having a capacity of 1,600 cubic feet of free air per minute against a pressure of 80-120 lbs. per square inch.

The steam cylinders are 16 and 25 inches, and the air cylinders 24 and 14 inches in diameter, the common stroke being 36 inches. Both air cylinders are fitted with Corliss inlet valves and poppet outlet valves. The engine has double wristplate long range cut off on the low



Horizontal Cross Compound Two-Stage Air Compressor, by the John Inglis Co., Ltd., Toronto.

pressure steam cylinder and single wrist plate on the high pressure. Speed is regulated by a combination centrifugal and pressure governor, pressure being taken from the discharge of the high pressure air cylinder and working an oil packed plunger on the governor. Both air cylinders and heads are water cooled, as is also the intercooler between the two cylinders. Steam passes from the H.P. to the L.P. steam cylinder through a reheating receiver standing above the cylinders, and heated by live steam. The engine runs non-condensing, and was designed for a speed of 90 R.P.M.

The pump pit runs the full length of the engine room at the foot of the dividing wall, the bottom of the pit being 9 feet below the level of the engine room floor. It is provided with a 6-inch auxiliary steam header running the full length of the pit, and connected with the main header by two 6-inch vertical legs provided with separators. This auxiliary header of course supplies steam to various pump units in the pit. The main steam header also carries a 10-inch vertical leg connecting to the line which provides steam for the hammers in the forge shop, for driving the fan

Before dealing with the feed pumps it may be as well to trace the course of the feed water on its way to the heater. The source of supply for the service water throughout the plant is a 2,000,000 gallon reservoir situated about 500 feet distant from the power house. From this reservoir the water is pumped up to a steel water tower, the bottom of which is 125 feet above grade level. This tower has a capacity of 100,000 gallons, and is supported by four steel legs resting on concrete piers. The two pump sets which raise the water to the tower were supplied by the John

Interior of Power House looking east. The two exciter units are seen in the for eground on the left of the illustration.

**Pump Pit and Piping.**

The wall dividing the engine room from the boiler house carries the main steam header on standard brackets. The header is of wrought steel, 12 inches in diameter, and has the branches riveted on. It is carried on the engine room side of the partition wall, and is connected to the boilers by 8-inch double bends. Steam pipes from the header to each engine have bends of large radius. The pipes to the Inglis air compressor and the two exciter engines are 4½ inch diameter, the other four engines having 7-inch pipes. All are provided with Crane separators.

engines of the indirect heating system and for heating those shops which use direct radiation.

The exhaust header is 18 inches in diameter, and, like the steam headers, extends the full length of the pump pit. All engines and pumps exhaust into this, part of the steam afterwards passing through a Hoppes open heater and part being used in winter for the indirect heating system in the various shops. From the heater the exhaust passes up a 16-inch galvanized steel stack to the atmosphere. The heater can of course be cut out when necessary for cleaning or repairs.

McDougall Caledonian Iron Works Co., Ltd., Montreal. They are located in the power house pump pit, and consist of duplicate 8-inch single stage horizontal turbine pumps, with extended bases. Each pump is direct connected on the same base with an 18-inch six-stage 70 H.P. horizontal Kerr steam turbine running at 1,500 R.P.M. The capacity of each set is 1,200 U.S. gallons per minute, against a head of 150 feet. From the tower the water passes to the main service pipe, and is thence distributed throughout the shops. The connection from the service pipe to the feed water heater is fitted with a reducing valve,

which brings the pressure down to about 5 lbs. per square inch.

From the heater the feed passes to two 14-10¼-10 Blake horizontal duplex piston pattern boiler feed pumps mounted on cast iron bed plates. Each of these pumps has a capacity of 200 U.S. gallons per minute against the boiler pressure of 150 lbs. They are cross connected in such a way that they may draw either from the reservoir, the service line or the heater; and their delivery is cross connected to the two feed lines, so that all danger of breakdown is practically eliminated.

Protection against fire is provided by two Underwriter duplex fire pumps built by the John Inglis Co. The combined capacity of the two pumps is 2,000 gallons per minute against a pressure of 200 lbs. per square inch. Two Marsh steam-driven vacuum pumps deliver the heating returns to the feed-water heater, and a small Canton-Hughes pump takes care of the engine and separator drips, delivering same to the heater or to sewer, as desired.

No provision has as yet been made for softening the water; though it is probable that it will be found necessary to treat the boiler feed at least, if not the whole supply, since the water is very hard. It is pumped from the Red River to the 2,000,000 gallon reservoir, as will be presently described.

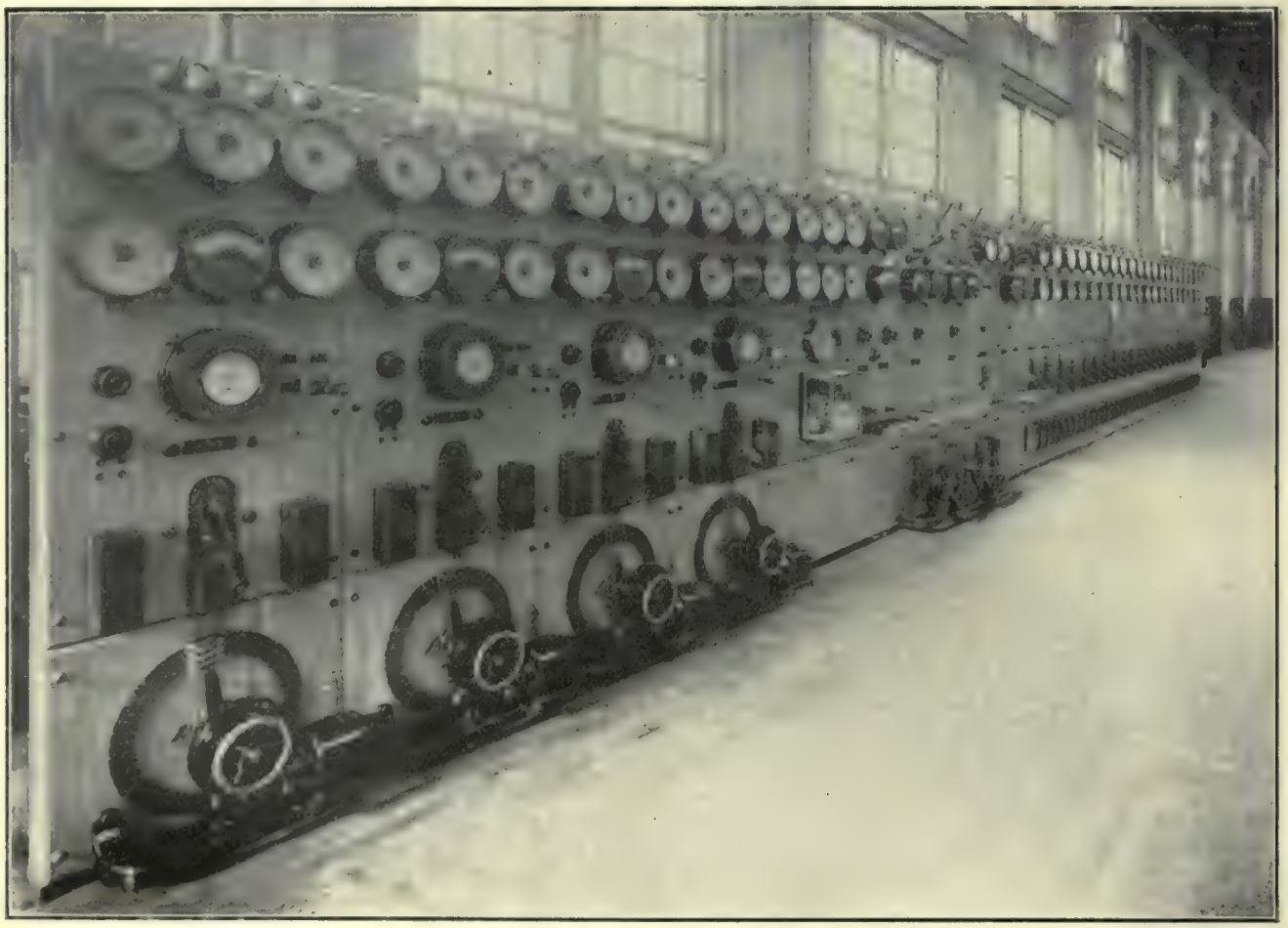
At the west end of the pump pit in the power house there is a 6-inch artesian well, 180 feet deep. A 4¼-3-36 Blake vertical deep well pump draws 40 gallons per minute from this well, and delivers it to a 10,000 gallon tank suspended below the main tank of the water tower From here it flows to the various drinking fountains throughout the shops, the Red River water being unsuitable for drinking purposes.

All valves and fittings on the steam, exhaust and water lines are of Jenkins or Crane make, the valves on the main steam lines being fitted with by-pass valves. The high and low pressure steam piping throughout the plant is thoroughly and neatly lagged with an efficient non-conducting material, and presents a very pleasing appearance. The various pipe lines are painted with distinctive colors to render their identification at all times easy. Thus the high pressure steam lines are colored white; low pressure steam, buff; heating returns, blue; compressed air lines, green; fire service, red; hydraulic pressure, brown; and general water service pipes, black.

The cylinders of the four Goldie & McCulloch engines are lubricated by Richardson automatic sight-feed oil pumps driven from the valve gear; while the Inglis air compressor is fitted with a Detroit sight-feed lubricator. All bearings are lubricated by the continuous gravity system, the oil flowing from an elevated tank to the various bearings, and from thence to a Burt unit type oil filter in the pump pit. From the filter a small steam pump elevates it once more to the tank.

### The Switchboard.

The switchboard was manufactured and installed by the Canadian Westinghouse Co., Ltd. It is composed of twenty-one panels of blue Vermont marble, having a total length of 52 feet and a height of 7 feet 8 inches. There are nine generator panels, the remainder controlling the various A.C. and D.C. feeders. The A.C. generator panels are equipped with an oil circuit breaker with inverse time limit relays, ammeters, voltmeters, indicating wattmeter, field ammeter and watt-hour meter. The rheostats for both A.C. and D.C. generators are electrically operated and have faceplates mounted on the sub-panels of the board. The total-load panel for the A.C. generators is equipped with ammeters, voltmeter, power factor meter and graphic recording



THE POWER HOUSE SWITCH BOARD, BY THE CANADIAN WESTINGHOUSE CO., LTD.

wattmeter. All the A.C. feeders are controlled by oil circuit breakers with inverse time limit relays, and have an ammeter and indicating wattmeter in each circuit, two feeders being mounted on one panel. The D.C. generator panels have carbon-break circuit breakers, ammeters, voltmeters and knife switches. The two D.C. feeder panels are also equipped with carbon-break circuit breakers.

All A.C. meters on the board are Westinghouse type "F," the D.C. meters, type "FL," and the oil circuit breakers, type "B." A Westinghouse synchroscope is supported on a swinging bracket at one end of the board. Each panel has an engraved name plate, and the general finish of the meters and circuit breakers is polished copper on a black background, so that the board presents a very handsome appearance.

**The Reservoir.**

As already mentioned, the water supply for the plant is obtained from a 2,000,000 gallon reservoir, which is filled by a pumping plant situated on the banks of the Red River some 6 miles distant. The reservoir is of concrete, and is 270 feet long by 60 feet wide, the bottom being 21 feet below ground level. It is divided longitudinally into two tanks by a central wall of reinforced concrete, resting on a footing of similar material. This central wall enables one-half of the reservoir to be cleaned out while the other half is in use.

The side and end walls are of plain concrete, as are also their footings. The central wall is 30 feet high, while the side walls are 25 feet in order to give sufficient slope to the roof. The latter consists of two thicknesses of 2-inch tongued and grooved planking resting on steel girders and purlins, and is covered with 4-ply waterproof roofing.

Flooding is provided against by a 12-inch cast-iron overflow pipe connected to sewer. Access to the interior of the reservoir is had by means of four hatches in the roof, iron ladders extending to the bottom of the tanks. The interior is wired for electric lighting, and heat is provided in winter by pipe coils taking steam from the low pressure line.

The pumping station on the banks of the Red River, from which the 2,000,000 gallon reservoir is filled, contains a producer gas driven plant consisting of two complete units in duplicate. Each unit comprises producer, scrubber and 60 H.P. single cylinder gas engine driving a vertical triplex force pump fitted with extra large suction and delivery valves, which are readily accessible. Each pump has a capacity of 40,000 gallons per hour, against a head of 50 feet. The suction lines run out into deep water and are 14 inches in diameter, the delivery line being 12 inches. The engines are cross connected with the two producers, and the pumps are cross connected with the two suction lines. This installation was supplied by T. H. & J. Daniels, Ltd., Stroud, England.

# Carpenter Shop, Pattern Shop and Grey Iron Foundry

*The relationship between the pattern shop and the grey iron foundry in every plant being so intimate, these two departments, together with the locomotive carpenters' shop, are here described in one article. All three are admirably equipped, the foundry in particlar being well worthy of attention.*

THE locomotive carpenter and pattern shops are accommodated in one building, numbered 6 on the view given on page 188. It is a steel framed, two storey structure, 100 feet long by 70 feet wide, and as may be seen, is adjacent to the foundry. The building has been constructed to be practically impervious to the attacks of fire from the outside, and precautions have been taken to prevent any fire, starting inside the building on the ground floor, from reaching the upper floor, which is used for pattern storage.

The lower floor, as above stated, is occupied by two departments; the carpenters occupying the front of the shop and the pattern-makers the rear half. An industrial track runs from the centre of the floor, with turntables and branch tracks to the grey iron foundry and stores platform. The toilet and locker rooms are on the north side, and are equipped with porcelain basins, etc., and steel lockers with expanded metal doors, similar in all respects to those in the other shops. Two lines of shafting run the full width of the shop to drive the machines for each department. Each line shaft is belted to a 25 H.P. motor. The shop is heated by the indirect system of radiation, and the lower floor is of 3-inch planks spiked to 4 x 6-inch timbers bedded in bituminous concrete, as in most of the other shops. A list of the mechanical equipment is given in the accompanying table:—

**CARPENTERS' DEPARTMENT.**

| | Machine. | Maker. |
|---|---|---|
| 1 | Planer, moulder and matcher | Berlin Machine Works. |
| 1 | Cut-off saw | Berlin Machine Works. |
| 1 | Band saw | Canada Machinery Corporation. |
| 1 | Swing cut-off saw | Canada Machinery Corporation. |
| 1 | Tenoning machine | Canada Machinery Corporation. |
| 1 | 24-inch planer | Canada Machinery Corporation. |
| 1 | 2-spindle shaper | Canada Machinery Corporation. |
| 1 | Woodworker's lathe | Fay & Scott. |
| 1 | 3-spindle boring machine | Greenlee Bros. |
| 1 | Wood trimmer | Oliver. |
| 2 | 2½-inch woodworking air drills | Cleveland Pneumatic Tool Co. |
| 1 | Combined grindstone and revolving oil stone | Mummert, Wolf & Dixon. |

**PATTERNMAKERS' DEPARTMENT.**

| | | |
|---|---|---|
| 2 | Patternmakers' lathes | Fay & Scott. |
| 2 | Band saws | Canada Machinery Corporation. |
| 1 | 2-spindle shaper | Canada Machinery Corporation. |
| 1 | 24-inch planer | Canada Machinery Corporation. |
| 1 | Face lathe | Canada Machinery Corporation. |
| 1 | Wood trimmer | Oliver. |
| 1 | Knife grinder | Fay and Egan. |
| 1 | Universal saw bench | Fay and Egan. |
| 1 | Combined grindstone and revolving oil stone | Mummert, Wolf & Dixon. |

The usual work benches, glue pots, hand screw clamps, etc., are also provided, and the shop is excellently laid out for its intended work.

**Pattern Storage.**

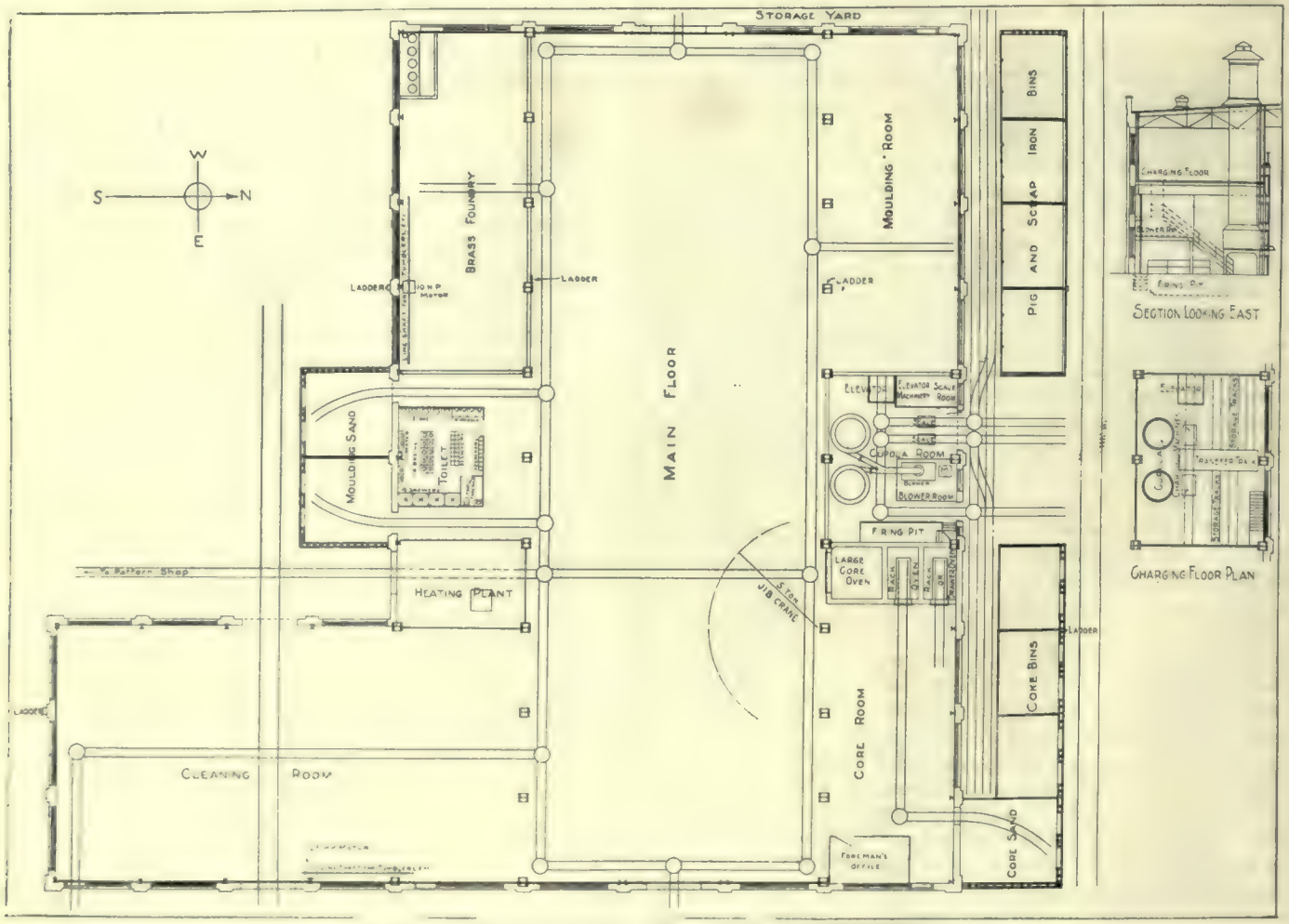
Patterns are stored in the upper section, which has a concrete floor supported on square concrete pillars. Metal shelves and racks for carrying the patterns extend to a height of about 12 ft., access to the upper ones being had from steel gratings, reached by steps and running along the front of the shelves about 6 feet above floor level. The rear part of the room is not equipped with shelves, being intended for storage of the larger patterns such as cylinders, wheel centres, smoke stacks, etc. Instead of the usual plug sockets and extension cables, numerous drop lights provide

artificial illumination. The pattern store is reached from the ground floor by an enclosed stairway fitted with fire doors, and heavy patterns are taken up by a hydraulic elevator running in an enclosed concrete shaft,also fitted with fire doors. In this way the risk of fire spreading to the pattern store from downstairs is reduced to a minimum. The elevator is operated by the shop water service pressure, equivalent to about 130 feet head.

**Grey Iron Foundry.**

This is probably one of the best equipped railroad foundries in the country, although not the largest. Not that it is by any means small, being 200 feet long by 130 feet wide, with a cleaning annex 60 feet by 80 feet. The building has a centre bay 70 feet wide and two side bays of 30 feet each. The plan on this page shows the general layout. The 70-foot bay forms the main moulding floor, and is served by a 15-ton electric traveling crane fitted with an auxiliary 5-ton hoist. The former lifts at 10 feet per minute and the latter at 30 feet, the traveling speed being 200 feet per minute. This crane was built by J. Booth & Bros., Rodley, Leeds, England, and is similar to those in the machine shop. The main bay is further served by an industrial track running around it, and by light bracket cranes affixed to the columns. Cylinders and other large castings are made at the lower end of the main bay, i.e., east of where the industrial track crosses the floor. Attached to the column nearest to the core oven is a 5-ton electric jib crane for handling the larger cores between the oven and the moulds. This crane was supplied by Geo. Anderson & Co., Montreal, and is fitted with a small elevated platform, on which is placed the controller, etc. This gives the operator a clear view all round, and enables him to handle the cores better when lowering them into the moulds. The crane is equipped with a 12 h.p. alternating current motor, built by the Lancashire Dynamo & Motor Co., and serves the cylinder floor only. It has a radius of 25 feet.

The north 30 ft. bay is divided into two parts by the cupola room and core ovens, which are centrally located to serve the whole foundry. The west half is used for moulding small work, and the east half forms the core room. Both sections are served by a 1-ton hand operated traveler, built by Geo. Anderson & Co. The core room is fully equipped with benches, shelves, etc., and an industrial track runs up the centre, terminating in one of the core ovens. The latter are three in number, all constructed by F. Hyde & Co., Montreal. The largest oven faces the main floor and is used for cylinder and other large cores. It measures 12 ft. x 12 ft. x 9 ft. and has racks on all three walls; heavy cores are run in on a truck. The other two core ovens are for general cores, and have racks and shelves on the north side and end wall only. The firing pit for all three ovens is located in the cupola room. The latter measures 30 x 40 ft. and contains two Whiting cupolas, a No. 7 and No. 9, having capacities of 11 tons and 16 tons per hour respectively. Pig, scrap and coke are brought in by industrial tracks from the bins outside, the trucks passing over track scales on their way to the 2-ton pneumatic elevator which raises them to the charging floor. The latter is of steel plate, laid out with storage tracks which are served by a small transfer table. In this way, a dozen or more loaded trucks can be stored ready for use. Each cupola is served by a Whiting pneumatic charging machine. Blast at 14 oz. pressure is supplied by a Sturtevant No. 11 blower (positive type) direct driven by a 50 h.p. Bruce Peebles A.C. motor. The blower outfit is enclosed in a 15 x 10 ft. room on an




GENERAL PLAN OF GREY IRON AND BRASS FOUNDRY.

elevated platform below the charging floor. Below this platform is a 36 in. x 60 in. cinder mill driven through gearing by a 5 h.p. motor.

**Brass Foundry.**

On the south side of the building there is a fully equipped brass foundry, measuring 80 ft. by 30 ft. This is an entirely self-contained little shop, making and drying its own cores, for which purpose it is equipped with a Hill & Griffith portable core oven. In the south-west corner there are four coke-fired brass furnaces, blast for which is supplied by a Canadian Buffalo Forge Co. 24-inch belt driven blower. The shop is served by a 1 ton hand traveler, and there is a line shaft along the wall driven by a 10 H.P. Bruce Peebles motor. This drives the blower, wet and dry tumblers, band saw, sprue cutter and double emery grinder. In the middle of the south bay stand the toilet and locker rooms. The lavatory arrangements here are very complete and include four shower baths in addition to the usual wash basins. The foundry is heated by the indirect system of radiation, the fan and heater coils being placed on an elevated platform near the toilet rooms.

Most of the moulding is straight handwork, but grate bars and other suitable patterns are moulded on a No. 2 Buch's gravity moulding machine, driven by a 10 H.P. motor. There is also a brake shoe moulding machine by F. Hyde & Co. Further equipment includes hand ladles ranging from 60 lbs. to 250 lbs., three truck ladles of 1,500 lbs. capacity, and three heavy geared ladles having capacities of 4,000 lbs., 10,000 lbs., and 20,000 lbs., respectively. The smaller flasks are of wood and the larger of cast-iron. The core room is provided with four benches, Hammer core machine, core wire straightener and all necessary equipment.

**Cleaning Room.**

The cleaning annex at the south-east corner, is at right angles to the main floor. It is 80 ft. long by 60 ft. wide and, like the rest of the shop, is extremely well equipped. A 5-ton electric traveling crane by Geo. Anderson & Co., Montreal, serves the whole floor. Castings can thus be loaded direct on to cars; a standard gauge track running into the annex. There is also an industrial track leading via the midway to all other departments. A 25 H.P. motor drives a line shaft against the east wall, where are placed the grinding wheels, tumbling barrels, etc. The latter are all fitted with dust hoods and exhausters.

**Pig, Coke and Sand Storage.**

The pig, scrap, coke and core sand are stored in bins arranged in a long covered-in shed to the north of the building. This is divided into bins, which are filled from the cars on the adjacent standard gauge track. Between the bins and the foundry wall are the industrial tracks by means of which the pig, scrap and coke are taken to the weigh-scales and elevator. Thus, to obtain raw material it is never necessary to go out into the open air—a great advantage in severe winter weather. Moulding sand is stored in bins on the south side, behind the toilet rooms. These bins are also filled from cars on the adjacent track.

The foundry is, of course, piped for compressed air for the use of the chipping hammers in the cleaning room and for sand rammers, etc., on the main floor.

It will be seen from the above that the Grand Trunk Pacific Railway will have a very fine foundry at their disposal. If any fault can be found it perhaps lies in the size of the cupola room, which in the writer's opinion is too small. As previously mentioned it measures only 40 ft. by 30 ft., and while this does not cramp the charging floor appreciably, it results in a very crowded ground floor. As may be seen from the plan, the elevator, track turntables and weigh scales are, one would think, too close to the cupolas, to escape rapid deterioration from the heat, cinders, etc., which are inevitable accompaniments of dropping the bottom at the end of the cast. The elevator, while very conveniently placed as regards the charging floor, is too near the right-hand cupola to allow the slag to be conveniently removed; the slag holes being inside the cupola room and on the sides of the cupolas. However, when the foundry goes into operation, these fears may prove groundless.

# Store House, Oil House, Offices, Sewage Pump House, Etc.

*What may be called the minor departments have been given the same careful attention as the larger and more important buildings. The oil house is well isolated from the storehouse and yet is not so far away as to be inconvenient.*

THE storehouse stands at the south end of the midway on the west side. It consists of a white brick building with a roof of reinforced concrete supported by pillars of similar material. The probability of having to add a second storey at some future time has been kept in mind in designing this roof. As is usual, the building stands upon a platform 4 feet above rail level to facilitate the handling of material to and from cars on the adjacent tracks. This platform is of reinforced concrete and extends all round the building; its front edge extending several feet into the midway to enable the electric traveler to handle material from it. Ramps at this end lead down to the midway level. The building, which measures 260 feet by 60 feet, is fitted up with the usual storehouse racks, shelves and bins, and has three doors on each side, giving access to the loading platform. As in the shops, hose reels are affixed to the walls at frequent intervals as a protection against fire, chemical extinguishers being also provided. The concrete floor has a coating of cement to give a smooth finish. The head storekeeper and his clerical staff are accommodated in the front portion of the building, which forms a handsome and comfortable office with hardwood floor.

The storehouse is heated by direct radiation, and lighted by 220 volt incandescent lamps. The platform is illuminated at night in the same way; the lamps being arranged over the storehouse windows in clusters of five with enamelled iron reflectors.

**Stores Platform.**

This building is numbered 10 on page 188, and forms an adjunct to the storehouse, from which it is divided by two tracks. Here is stored the heavier material, such as needs a crane to handle; the building being equipped with a 5-ton hand operated traveler built by Geo. Anderson & Co. As in the case of the storehouse, the stores platform, which is 180 feet long by 58 feet wide, stands 4 feet above rail level, and projects out into the midway sufficiently far to be served by the midway crane. The structure on the platform is a light steel frame covered in with corrugated sheeting and a roof of tarred felt. There are two double doors on each side and one at each end. The runway for the crane extends out to the front of the platform; special doors being fitted to allow it to pass out of the building. In this way, loads can be transferred to or received from the midway crane. The platform and shed

are lighted by incandescent lamps similarly to the storehouse.

### The Oil House.

The various kinds of oil used, with the exception of crude oil for fuel purposes, are stored in an oil house, situated some distance to the rear of the storehouse. It is surrounded by a concrete unloading platform at the same level above rail as the storehouse platform, with which it is connected by a gangway. The oil house consists of a small brick building, 30 feet by 40 feet, with a concrete basement in which are placed nine horizontal cylindrical steel tanks for the storage of the different varieties of oil. These are arranged to be filled by gravity from tank cars, or from barrels through openings in the platform, as may be desired. There is a hydraulic elevator, operated by the ordinary water service pressure, which handles barrels, drums, etc., between the basement and platform.

The upper floor is divided into two rooms. The rear room is used for storage of tallow, cotton waste, etc., while the other contains Bowser self-measuring pumps for raising oil from the storage tanks below. Gasoline is stored in a tank buried underground, outside the building and pumped up in the same way. Direct radiation is used for heating this building.

### Motive Power Offices.

The motive power administrative and clerical staff are accommodated in a brick building on the east side of the midway, opposite the stores platform. It measures 68 feet by 60 feet, and consists of two storeys and basement. The usual fireproof vault runs up the centre of the building with doors on each floor. In the basement are the lavatories and storage rooms and also a large laboratory for the engineer of tests. The ground floor is occupied by the timekeepers, accountants, etc.; while on the upper floor are the drawing office, blueprinting room. etc. The floors are of maple and the interior woodwork generally has a handsome appearance. The building is heated by direct radiation, and lighted by incandescent lamps.

### Sewage Pump House.

A main sewer surrounds the plant, to which connections are made from the various shops. As there is not sufficient fall from the site to the Red River for a gravity flow, it has been found necessary to put in a pumping station to force the sewage to the river. The pump house is located 1,400 feet west of the storehouse, and is not seen on page 188, being outside the boundaries of the plan there shown. It is a concrete building, 31 feet by 28 feet inside, and rests on concrete foundations. Below the floor is a large sump, the bottom of which is some 25 feet below ground level. Into this the main 42-inch sewer discharges; the sewage being pumped thence to the Red River by two submerged pumps driven by direct connected vertical motors, located on the floor above. The larger of the two units is a 26-inch vertical centrifugal pump, having a capacity of 16,000 Imperial gallons per minute against a head of 48 feet. It is direct driven by a 350 h.p. 3 phase 60 cycle 550 volt motor, provided with a thrust bearing to take the weight of the rotor only. The smaller unit consists of an 8-inch vertical centrifugal pump direct driven by a 30 h.p. motor of the same type. This outfit was designed for a capacity of 2,000 Imperial gallons against a head of 15 feet. It will be in operation at all times, while the larger unit is intended to take care of storm waters, etc. The pumps are automatically started and stopped by means of floats, which operate the motors by means of two Cutler-Hammer automatic starting panels. Hand control is also provided for use when necessary. The switchboard is of blue Vermont marble and has a panel for each motor, in addition to the automatic starting panels. Current is brought from the power house by a lead and paper covered feeder, laid in a tile conduit. The 350 h.p. motor panel has the following equipment:—one 400 amp. 3-pole singe throw automatic oil switch; one 500 amp. Weston ammeter, and one 600 volt Weston voltmeter. The other panel has one 50 amp. automatic oil switch; one 60 amp. Weston ammeter, and one 600 volt Weston voltmeter.

The pumps were constructed by the John McDougall Caledonian Iron Works Co., Ltd., Montreal, and the motors by Allis-Chalmers-Bullock, Ltd., Montreal. The two pumps are connected to one discharge pipe, 42 inches diameter. This pipe, some 6 miles in length, is provided with necessary manholes, vents, etc.

### The Locomotive Roundhouse.

The 24-stall roundhouse at the south end of the midway has been in operation about 2 years, but really forms a unit in the Transcona plant since it will make use of the locomotive machine shop, having none of its own. The locomotive foreman will welcome the opening of the big shop, as he has decidedly been working under difficulties hitherto. The roundhouse is at present lighted by gas generated on the premises from gasoline. However, electric lighting will shortly be installed, current being taken from the works powerhouse, which will also probably supply compressed air. The latter commodity is at present delivered by two 11-inch Westinghouse compressors. Heating is both by direct and indirect radiation, the former supplementing the latter in very severe weather. Steam is generated in two return tubular boilers, built by E. Leonard & Sons, London, Ont.

The turntable is operated by an air motor, and when once it has got "coupled up" to the main plant, the roundhouse will be thoroughly up-to-date in every way.

### General Remarks.

A feature of the Transcona plant is the distribution of the various equipment items. The leading Canadian toolmakers are all strongly represented, while Great Britain and the United States have been able to successfully compete in many instances, noticeably in the crane equipment. With two or three exceptions, all the British machines, including the Booth cranes, were supplied through Mussens, Ltd., Montreal. Other supply houses who secured large orders include Williams & Wilson, Montreal; Rudel-Yeates Machinery Co., Montreal; The Canadian Fairbanks Co., Ltd., Montreal; The A. R. Williams Co., Toronto, and Joseph T. Ryerson & Son, Chicago. The detailed lists on this and previous pages, show the large number of machine tools supplied by the John Bertram Co., the Canada Machinery Corporation and R. McDougall Co. The numerous steel lockers throughout the plant were supplied by the Dennis Wire & Iron Works Co., Ltd., London, Ont. The pipe lagging in the powerhouse and elsewhere was done by the Winnipeg branch of the Philip Carey Co.

The contract for the supply and installation of the leather belting was secured by D. K. McLaren, Ltd., Montreal, and following firms supplied motors for the individual and group drives, cranes, blowers, etc. After each name is given the aggregate horsepower supplied:—Lancashire Dynamo and Motor Co., 930½ H.P.; Canadian Westinghouse Co., 907 H.P.; Allis-Chalmer-Bullock Co., 767 H.P.; Canadian General Electric Co., 335½ H.P.; General Electric Co., 60 H.P.; Crocker Wheeler Co., 31½ H.P.; Allis Chalmers Co., 31½ H.P.; Rhodes Motor Co., 10 H.P.; Electro-Dynamic Co., 7½ H.P.; Westinghouse Electric Co., 6 H.P.

# CANADIAN MACHINERY
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Vol. VIII. JULY, 1912 No. 7


## THE N.T.R. SHOPS, TRANSCONA.

THE National Transcontinental Railway Commission and the Grand Trunk Pacific are to be warmly congratulated upon the magnificent locomotive shops just completed at Transcona, and fully described in our present issue. Great credit is due to the N.T.R. officials responsible for the design and equipment; and also to the contractors, who have carried out the work in a most thorough and businesslike manner. The first concrete was poured just three years ago, and as only about two-thirds of the whole plant is as yet completed, it will be seen that ample time has been taken to do the work in a first-class manner. A good many difficulties, however, had to be contended with, as the shops are located at some little distance from Winnipeg, on an isolated site, subject to flooding every spring. The latter trouble has been overcome by covering the site with a heavy gravel fill, but the tales told us, when visiting the shops, of the trouble experienced by the contractors' superintendent, owing to the excavations filling up quicker than they could be pumped out, are more or less interesting and amusing, now that the trouble is past. The locomotive department and power house are ready to be turned over to the Grand Trunk Pacific Railway, and the steel framework of the freight-car shop and planing mill is erected; so that the whole plant may be expected to be in operation by the time the N.T.R. is completed from Moncton, N.B., to Winnipeg in the fall of 1913.

With regard to the machine tool equipment in these shops, Canadian and the United States makers are about equally represented, while Great Britain is not far behind. A study of the lists of tools given in our article will show, as is only to be expected, that the United States furnished for the most part lines that are not yet manufactured in Canada. In a few individual instances this is not so, but generally speaking it will be found to be the case. We have no definite information as to the amount of money spent on machinery in each of the three countries mentioned; but as fas as mere numbers go, the machines supplied by each are roughly in the following proportions:—U.S.A., 40 per cent.; Canada, 37 per cent.; and Great Britain, 23 per cent. This includes the cranes, which are nearly all of British manufacture.

Our country is developing so rapidly and has such an assured future before it, that we confidently look forward to the time when a large plant like that at Transcona can be completely fitted out with Canadian equipment.

## OUR OUTPUT RATING.

A GOOD many years ago, it was our privilege to see and know something of a steam propelled barge, engaged in the coal-carying trade on a large inland fresh water lake. The crew consisted of one man, who acted in the combined capacity of owner, captain, deckhand, engineer and fireman. The barge was some 70 feet long, 14 feet beam, 6 feet molded depth, and drew about 3 feet of water, loaded. Her motive power consisted of a vertical boiler, single cylinder non-condensing engine (a puffing Billy) with a one-blade propeller. The steam pressure caried was 20 pounds per sq. inch. The propeller was not one-bladed by design, but became so by accident, and remained so by indifference and carelessness. Fifteen miles in sixteen hours was the rated speed of sarcastic humor.

We are apt to believe that modern equipments, methods, and operations, leave no room for the existence of such seemingly old time happenings. Without making a too literal application, are not individual experiences much in the nature of a "15 miles in 16 hours" rate? Is it not a fact that plant equipments are in operation that attain their purpose at a like rate, and may it not be true that methods of manufacture still flourish by which output, whole or part, is got by a one-blade propeller as it were; the original design and purposes having been side-tracked by carelessness and indifference Individually, we have each one, some blades fewer than we were designed for, or have chips off some of them. We have not attained to that prominence in our profession we had mapped out for ourselves, and have not as a consequence secured its cash equivalent. We reason that our personal equipment is all right, and point to want of encouragement, or in other words to adverse undercurrents and headwinds. Are we sure that our motive power is all it might be, and if so, are we delivering it with a full-blade propeller Are we putting our knowledge to telling practical use?

Knowledge is power, only if applied, and unless it is so, we are somewhat in the position of a boiler in which steam is generated for the purpose of blowing it off again at the safety valves. Unless we apply our knowledge effectively, we cannot expect to make satisfactory progress. This barge made little headway, due to the indifference of its owner in the matter of supplying the lost and broken propeller blades. Our indifferent showing may be in the half-hearted way we go about our duties; in the thoughtless handling of some emergency when we know better; or in the determined attitude of being content with doing as little as we can, for the little we happen to get.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

### CASE-HARDENING BOXES FOR GEARS.

By Avery E. Granville.

WHEN case-hardening gears in square boxes, it is impossible to get them hardened evenly, as the heat is not the same in all parts of the box; so we have been using the type of box shown in the accompanying half-tone for nearly two years.

The box consists of a cast iron pot (A) and a base (B), with three legs on it; the combination appearing as at (C). In using this box, the pot is packed full of gears, and ground bone is packed in between the gear teeth and the outside of the pot; about ¾ inch of space being allowed for the purpose.

Case-Hardening Boxes for Gears.

The bottom is then inverted over the pot, and the whole thing turned over and set into the furnace.

The legs raise the box high enough for the heat to play under and around it, ensuring an even heat; and the size and shape of the box give the maximum result with the least waste of ground bone. As the patterns for a box of this kind are easily made, they can be produced in any size at a trifling cost. Another thing in their favor is that the crack can be easily fluted with fire clay if necessary, although as a rule the fit is so good that little gas can escape.

### SIMPLE METHOD FOR CUTTING SQUARE-THREADED SCREWS.

By T. R.

CUTTING square threads in the lathe may be much simplified if performed in the following manner. Caliper the diameter of the bottom of the thread to be cut and grind a vee threading tool that will reach to the bottom and just clear the width of the space between the tops of the teeth; then proceed to cut the thread as if it were a vee thread. When you reach the bottom diameter desired, change your tool for one of the proper width for the square thread and finish the job with this. It will be found that you save not only time, but breakages of the tool, especially if the thread is a small one and you have not a steady rest to help you; the reason being that by this method you practically only cut the sides down square to the bottom, whereas, if you start the job with a square tool you have to take light cuts only, and the dip of the tool leaves the job anything but perfect.

Just try it out, and you will never again dread the job of cutting a square thread.

### A CONVENIENT TOTE-BOX.

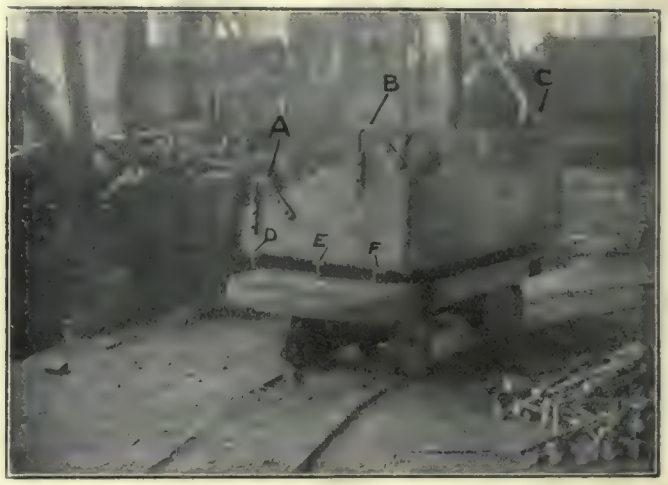
By Avery E. Granville.

IN our bolt shop we handle thousands of bolts a day, and in order to avoid unnecessary handling, we use the type of tote-box shown in the accompanying half-tone. These tote-boxes are made of heavy boiler iron and have strong eyes riveted to each end, as shown at (A), (B) and (C), the fourth one not being visible. These eyes are for the hooks of the crane chains, and are so placed that when the box is lifted it has no tendency to spill the contents.

At (D), (E) and (F) are three lengths of "T" iron riveted to the bottom, both for stiffness and to afford feet for the tote-box as it rests on the top of the small truck; a flat bottom having more of a tendency to let the box slip or skid around. The open side makes the box easy to load or unload, and in case it is wanted to dump the whole contents at once from the crane, all that is necessary is to slack away on the chains nearest the open side and the contents will slide out.

In using this box, a truck with a tote-box in place is run to the press where the long bars are cut into bolt lengths, and as fast as the pieces are cut off they are thrown into the box. When the box is full, the truck is run to the forging machine where the heads are made on the pieces. The bolts are then tossed into another box, which, when full, is run to the bolt cutter where the threading is done.

The crane picks up the tote-box and carries it to the storage warehouse or to a car waiting for shipment.




A Convenient Tote-Box.

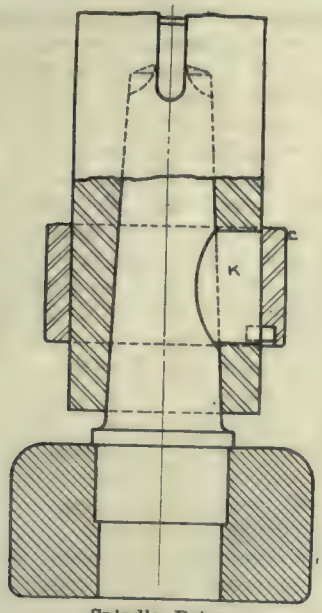
### A SPINDLE DRIVE.

By D. O. Barrett.

WE experienced a great deal of trouble from breaking the tangs off the tapered shank of a tapping chuck which was used for large pipe taps. The body of the chuck was of cast iron with a square hole; all taps being supplied with a standard square. The steel shank was forced into this body, and in addition, four holes were drilled in the corners and pins driven in. The spindle of the drill press was removed and the tool steel key, K, fitted. At the bottom is a projecting pin which serves to retain the collar, C. This collar is placed

on the spindle before the chuck shank is inserted and then dropped down over. The key readily drops out when the shank is driven out in the usual manner by means of a tapered drift.

While on the subject of drill presses it seems that manufacturers overlook a




Spindle Drive.

seemingly insignificant but important point. The attachment of the counterweight chain to the sleeve on most of even the medium sized presses is by means of a ¼-inch eyebolt tapped into the end of the rack. Sooner or later this either breaks or pulls out, which usually necessitates tipping over the press in order to get at the chain. After several experiences of this kind we made a U bolt, wide enough to go over the side of the rack and riveted to it; the rivet extending entirely through. A little more attention paid to some of the minor details of machine tool design would be appreciated by those who have to operate the machines.

## POSSIBILITIES OF FINE MEASUREMENT.

By J. Davies.

THE test room micrometer here shown uses two threads of different pitch in such a way that in one revolution of the spindle the measuring points of the micrometer will advance or recede in amount equal to the difference of the pitch of the two threads.

Referring to fig. 1, it will be seen that the spindle is threaded the standard 40 threads per inch, R.H., in the ordinary way, and for each revolution will advance

$$\frac{1}{40} \quad \text{or} \quad \frac{100}{4000}$$

inch. The other end of the same spindle is threaded

$$\frac{99}{4000}$$

inch pitch, R.H., and engages with an attached sleeve (D), which has a long supporting bearing inside the body of the micrometer. The outside of this sleeve has 25 fine longitudinal slots (not shown in the cut) to correspond with the 25 graduation marks on the measuring thimble, and in these slots the sliding key (C) engages. There are two lock nuts. Lock nut (A) locks the attached sleeve (D) to the spindle, so that the attachment does not interfere with the use of the micrometer in the ordinary way. Lock nut (B) locks the sleeve to the body of the micrometer to preserve the setting.

The method of operation is as follows: Use the micrometer in the ordinary way when measuring thousandths. To sub-divide

$$\frac{1}{1000}$$

measure to the nearest

$$\frac{1}{1000}$$

in the usual way; then push up the sliding key (C) to prevent rotation of the attached sleeve. Loosen lock nut (A) slightly—this will allow the measuring point to move in an opposite direction to that of the spindle and the actual opening or closing of the micrometer per revolution will be in amount equal to the difference in pitch of the two threads, or

$$\frac{100}{4000} - \frac{99}{4000} = \frac{1}{4000}$$

With the sliding key (C) raised, it will require four revolutions to record

$$\frac{1}{1000}$$

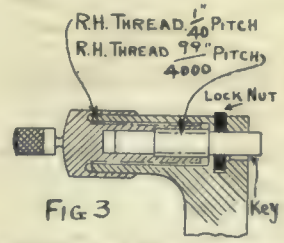
since one revolution equals

$$\frac{1}{4000}$$

consequently, each of the 25 graduations on the thimble will now record

$$\frac{1}{100{,}000}$$

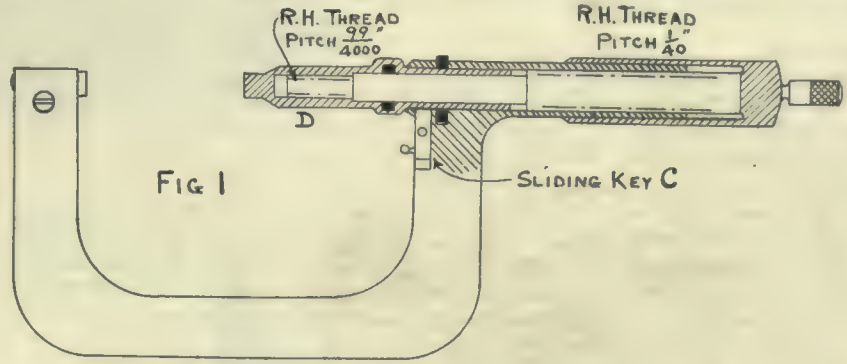
and the vertical lines that formerly represented tenths will now represent thousandths. With vernier graduations, as used on some micrometers, a reading of 1 millionth can be obtained. After completing the measurement, turn the micrometer back to the nearest thousand, lock the sleeve on the spindle, push down the

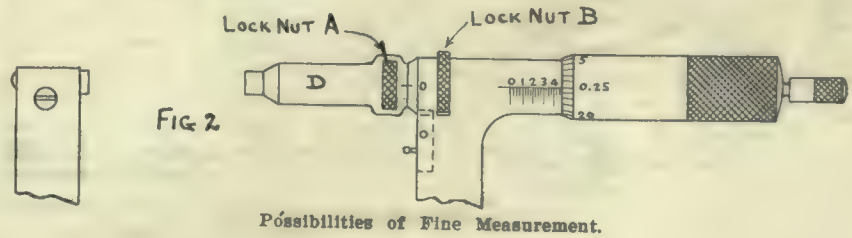



Possibilities of Fine Measurement.

sliding key and you have, again, the ordinary micrometer.

The same idea could be carried out by using the anvil end of the micrometer as shown in fig. 3. In this case, the twenty-five longitudinal slots would not be required and the sliding key would be replaced by a permanent one, as the attachment would be used for sub-dividing thousandths only. There would be no




Possibilities of Fine Measurement.

difficulty in cutting a thread having a pitch of

$$\frac{99}{4000}$$

inch, since it lends itself very readily to sub-division.

Take a lathe having a lead screw of ¼-inch pitch. The ratio of wheels is

$$\frac{99}{4000} \times \frac{4}{1} = \frac{396}{4000}$$

and the wheels required are

$$\frac{12\times33}{100\times40} \quad \text{or} \quad \frac{24\times33}{100\times80}$$

This micrometer is protected in Canada and the United States by J. Davies, Third Avenue, New Toronto, Ont., and is intended for the use of scientific instrument makers and others doing extremely fine work. Such refinements are, of course, unnecessary in the average tool room or machine shop.

## A CYLINDER REAMER.

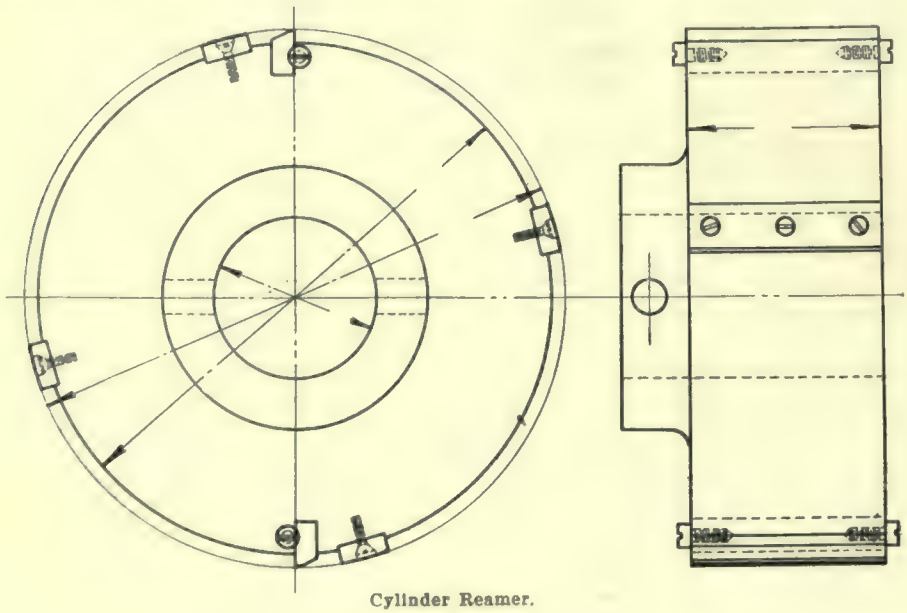
By D. O. Barrett.

THE reamer shown in the cut was designed to finish the cylinder of an engine which we were adding to our regular line, but wished to give a thorough tryout before finally going to the expense of purchasing tools for its manufacture.

The body is of cast iron; two inserted tooth cutters being provided of carbon steel, 7-16 by 15-16 inches, peened in, and further held by the screws at either end. Just back of, and also between the blades there are placed strips of red fibre held in place by countersunk machine screws. The fibre blocks were turned before the blades were finally ground, so that they were slightly larger than the reamer size. However, as they entered the cylinder, the sharp edge easily cut them to the proper size. Roughing and finishing reamers were provided, the former being .004 inch undersize. They produced an almost mirror finish, with a maximum variation either in rotundity or from end to end, of about .0003 inch. They seemed to be very free cutting, and the last reamer was made slightly loose on the bar and pin to give a floating effect. Of course, the fibre blocks would not last for long, as they cut considerably from the chips; but if these were kept blown out of the cylinder, the wear would be small, and in any case it would be a small job to replace them.

## INTERESTING LEGAL DECISION.

A LEGAL judgment of particular interest to contractors and engineers has been handed down in the Court of Review, recently, in Montreal, Que. The case arose over the collapse of a tank. The lower court had condemned the defendants to pay $9,590.68 damages on the grounds that the collapse of the tank on the building was due to the weakness and insufficiency of the walls, and that it was incumbent upon the defendants, as contractors, to assure themselves of this condition, before attempting to erect the superstructure and tank. The Court of Review whilst maintaining the damage award, holds that the collapse was due to a defect in the construction of the steel work supporting the tank. For this, the defendants were also responsible by reason of the fact that they had undertaken to carry out the work on the understanding that they would look after all details connected with such work.



Cylinder Reamer.

## LOCOMOTIVE WITH MECHANICAL STOKER.

A RECENT trip on an American locomotive equipped with a mechanical stoker resulted in the capability of the latter to maintain steam pressure over a long and difficult section of line being amply proved. According to a short account of the test which appears in the Railway Gazette, the engine was of the 2-8-0 or consolidation type, and the distance covered 137 miles. The train consisted of twenty-two loaded wagons weighing 906 tons. The line rises on a gradient of 10.6 feet per mile for about five miles, the next three miles is 26.4 feet to the mile, and for the succeeding five miles it is 60.6 feet per mile. In addition to these gradients there are others of a similar description, and during the whole of the climb up these hills the driver paid no attention whatever to the steam so far as the application of the injector was concerned. One injector was started and worked without being shut off for a distance of twenty-eight miles, requiring 1 hour 40 minutes to cover.

In the meantime, one injector was sufficient to maintain the water supply while the engine was working so heavily and the second ejector was started and worked as occasion demanded. This was done seven times in the period mentioned, the time of operation ranging from one minute to four minutes each. In no case was there any diminution of steam pressure, and on several occasions the second injector was put on solely to prevent the safety valve from lifting. The stoker was started and stopped thirty-one times on the trip, its period of continuous action varying from one to eighty-three minutes. On the easy and undulating portions of the road the stoppages were quite frequent.

## BRASS MELTING FURNACES.

THE United States Bureau of Mines will make an investigation of brass melting furnaces with a view to ultimately reducing the oxidisation or volatilization losses of metal. A committee of the American Institute of Metals is co-operating with the Bureau of Mines and the members of this organization are requested to furnish detailed information covering the operations of their brass melting furnaces. The data sought include the shape and dimensions of furnaces, details of fuel and air supply, metal charges, percentages of losses, etc.

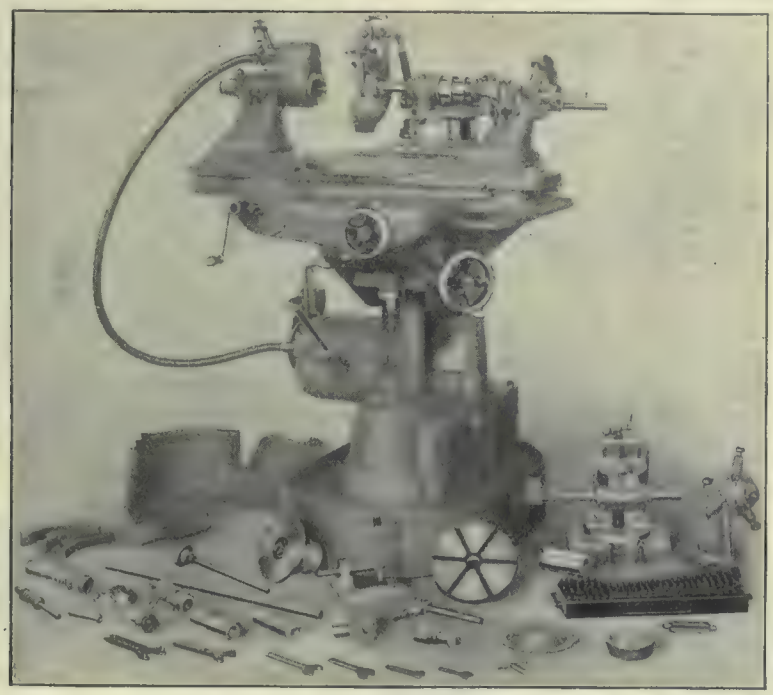
**Mr. Rudolph Kauert**, of Kauert & Doehler, machinery dealers, Toronto and Montreal, has gone to Europe on business.

# DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

## UNIVERSAL AND TOOL GRINDING MACHINE.

A NEW Universal and tool grinding machine, illustrated in the half tone, herewith, was recently placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. In construction it differs materially from other products of this type. It will take work up to 18 inches in length and will swing 12 inches in diameter. This machine is specially adapted to the grinding of milling cutters, formed cutters, straddle and face mills, beveled and angular cutters, end mills, straight or taper reamers, etc. Cylindrical grinding, straight or taper can be done, and with the attachments that can be furnished if desired, internal and surface grinding can also be accomplished.



No. 12 Universal and Tool Grinding Machine.

The design and construction, as shown by the cut, gives evidence of a careful study of the requirements for a grinding machine of this type in securing the greatest efficiency, together with accuracy in the finished product. There is exceptional rigidity and freedom from vibration, owing to the disposition of the metal; for example, the base and column are cast in one piece, thus affording a rigid support for the wheel spindle, and the knee which carries the saddle and table is well braced internally with stout transverse sections. The spindle head has a transverse adjustment of 1½ inches, a vertical adjustment of 4 inches, also a radial adjustment to any desired position. The main movements are obtained in the knee which slides on ample ways on the column, in the saddle mounted on the knee, and in the sliding table which rests upon the saddle. The cone has 2 steps, is driven by a 1 inch belt, and the speeds are 3,180 and 3,970 revolutions per minute.

The sliding table is operated by a crank located on front of the saddle and has a longitudinal adjustment of 26 inches, a transverse adjustment of 8 inches, and a vertical adjustment of 10½ inches. The table can be swiveled 45° either side of central and securely clamped in position; the setting being facilitated by a graduated surface on the swivel table. Adjustable stops are also provided. Both the transverse and vertical adjustments are obtained by means of the handwheels conveniently located on the front and side of the machine respectively. They are graduated to read to thousandths of an inch. The saddle and table ways are wide and long, insuring rigidity and correct alignment. Metal guards afford ample protection against dirt and grit.

A variable speed mechanism consisting of multiple friction disks located at the side of the machine furnishes 16 changes of work speeds varying from 110 to 530 revolutions per minute. To change the speed it is necessary only to move the lever to a position opposite the required speed; the variations being shown by figures cast in the cover of the mechanism. The lever at the front provides means for starting and stopping the mechanism independent of its drive. The speeds are transmitted to the headstock by means of a flexible shaft. By such a drive a high efficiency is obtained and a wide range of speeds is possible.

In a machine of this type, the provision for wet grinding is an unusual and valuable feature. A tank is cast around the base of the machine which not only enlarges the capacity, but also increases the weight, an additional advantage. The waste water is well taken care of; suitable guards prevent the spray from wetting the floor.

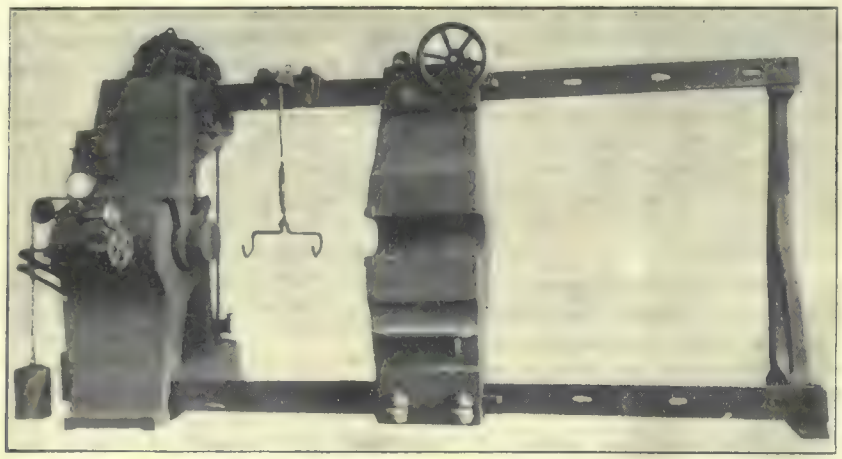
The value of a cutter grinding machine is greatly increased by the convenience with which it can be operated and cared for. To this end, the location of the levers and handwheels should be noted. All movements are controlled from the front, likewise the changes of work speed. The protection of working parts has been given careful attention, the ways being always covered and all oil holes and parts needing frequent adjustment carefully protected.

## MOTOR-DRIVEN HYDRAULIC WHEEL PRESS.

BESIDES being used in all car and locomotive shops, a wheel press is now considered indispensable to the equipment of steam and electric railways, lumber yards, coal yards and mines, machine shops, foundries, cement plants, ship yards, dock companies and other concerns using a large amount of machinery or rolling stock.

The motor-operated wheel press shown in the accompanying illustration is a highly perfected machine, and attention is directed to its convenience in operation and simplicity of construction. For convenience in handling heavy work such as locomotive drivers and irregular shaped work that cannot be rolled to and from the press, the upper horizontal parallel bar is not directly above the lower, but at a slight angle, which permits handling the work with an overhead crane. The plungers (not shown in the photograph) are operated by

eccentrics on the back shaft, which is driven by cut gears having 3½ to 1 ratio. The plungers operate without vibration, and are practically noiseless. The ram is drawn back automatically as soon as the pressure is shut off from the pumps. An extra valve to connect with the city water line is furnished when it is possible to have such service.



Motor-driven Hydraulic Wheel Press.

By opening this valve (before using the pressure from the pump) the steel-faced ram is moved out against the work more rapidly than it could be done by the pumps, the city water line valve being afterwards closed, the pump valve opened, and the plungers started.

**Pump Equipment.**

The press is equipped with low and high pressure pumps. The former operates the ram up to a certain pressure with greater speed than does the latter, and consequently increases the amount of work that can be handled by the use of a high pressure pump alone. The low pressure cylinder is arranged with a relief valve, so that the pump works until about 50 tons is reached, when it automatically cuts out; the pressing operation being continued at a slower rate with the high pressure pumps.

The pump cylinders are cast from a special semi-steel mixture, giving great strength, and making them proof against leakage. All presses are provided with a safety valve to prevent overloading, and the plungers are driven by a direct current, 7½ horse power, Westinghouse motor. E. R. Caldwell & Co., Bradford, Pa., are the builders of this press.

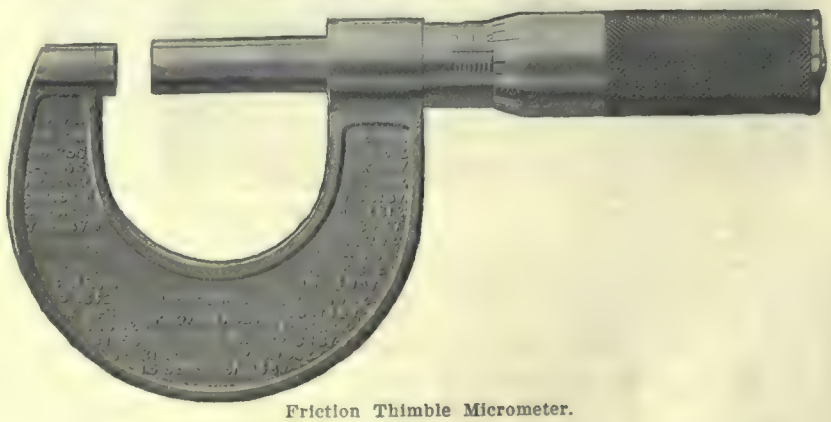
## FRICTION THIMBLES ON MICROMETERS.

FOR several years past, the different manufacturers of micrometers have been fitting, when instructed, a friction or ratchet stop on the end of the thimble. The purpose of this was to overcome the difference in the "feel" of the different parties measuring. One man might have what is called a "heavy feel" and another a "light feel," and if a micrometer without this friction or ratchet stop were used, they would obtain a different measurement. In using the stop the ratchet or friction slips when more than a certain amount of pressure is applied and so prevents the measuring screw from turning further. This has an added advantage in that there is no danger of springing the frame. We claim an advantage in the friction over the old style ratchet in that it is much more smooth in its forward action and fully as positive in the reverse action.

The cut shows the friction stop which (when instructed) is put on any of the Slocomb micrometers. This device consists chiefly of a coiled flat spring of German silver. The inner end of this spring is attached to a washer, which is clamped to the end of the thimble by shoulder on central screw. The outer end slides around inside of large bore in the outer revolving part, and is so arranged that in turning to the right the device slides over the spring; but in turning to the left, the friction uncoils the spring, causing it to drive positively in this direction. The device has no parts that are liable to get out of order, and allows for a large and substantial screw for attaching; it also allows of reducing the knurled part to a small diameter, so as to provide a speeder as well. The German silver spring does not require lubrication and is not liable to lose its tension. Another advantage is the absence of click, which not only makes a ratchet-stop rough in its action, but prevents it stopping as positively as does this friction device.

The friction thimble is based on the same principle exactly, but the micrometer thimble is so constructed that the knurled part of the thimble revolves, instead of simply the end. The advantage of this is, that the friction may be worked with the same hand which holds the tool, while with the stop, it is necessary to hold the work in a vise; the tool being in one hand and the friction being operated with the other. With the friction thimble, the work is held in one hand and the tool in the other; the friction being worked by the thumb and forefinger of the hand holding the tool. This is of immense value in making quick measurements, and the friction thimble may be used in this manner even although the micrometer is opened to its full capacity.

The friction thimble does not prohibit the micrometer being used in the regular way, that is, the same as one without either friction thimble or friction stop, because the friction thimble only extends over a little more than half the full length, therefore, while it can be used, when opened to its limit, still one may operate the screw without using this feature when desired.



Friction Thimble Micrometer.

This device is furnished only on the polished pressed frame micrometer No. 26, which has the decimal equivalents raised on the frame. This tool has the same adjustment feature as the other Slocomb micrometers; the two nuts giving a long bearing for screw and making a fine adjustment. The J. T. Slocomb Co., Providence, R.I., are manufacturers of the apparatus.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## CASTING PIPES WITHOUT CORES.

THE cost of producing cast iron pipe has up to the present been very largely augmented by the fact that it is necessary, in order to produce a uniform and even bore, to employ a length of dried sand core equal to the total length of pipe section to be cast. It is, of course, not possible to cast good pipes in green sand when pouring the metal into a stationary mold with a core, partly because the iron in falling down into its position would wash away the surface of the mold, and also because the green sand mold cannot withstand the great pressure exerted by the molten metal. The present standard practice, therefore, makes it necessary to go to the expense of cores, utilizing core ovens for drying purposes, and also drying ovens for the molds.

Quite apart from the initial cost incurred in such methods, there is a serious loss of time in preparing the molds and cores; necessitating considerable manual labor and a larger storage space, than would be required if a satisfactory means for eliminating this cumbersome method could be adopted. In times past, patents have been issued for the purpose of producing a cast iron pipe without the use of cores, but so far as can be judged from the results of actual practice, it does not appear that anyone until recently has been able to cast pipes in a continuous manner in standard lengths.

Recently, however, a process has been developed by Mr. Hermann Molinder, of Soderhamn, Sweden, which appears to be successful in producing good sound pipes without the use of cores. This marks a radical departure in the method of making this particular product, and as cast iron pipework is one of the most extensively used manufactured iron products in existence, in connection with civil engineering, gas, and hydraulic undertakings, it may be useful to refer to this new process with some amount of detail.

### Molinder Process—The Mould.

Fig. 1 shows, both in longitudinal and cross sections a rotary mold, designed for founding such tubes. A frame supports the mold in ball or roller bearings. The outer casing of the rotating portion is conical, and made of cast iron without longitudinal separation. Within is contained the casting box, which is also made conical, of cast iron, and without longitudinal split. This casting box, lined with ordinary molding sand, either in the dried or green state, is introduced into the outer casing through one of the ends, and is coned so that it is always correctly central with relation to the ball bearings upon which the outer casing rolls.

It will be seen that the wall of this casting box is provided with a series of openings. In this way the gas generated in the lining as the molten metal is poured upon it, can escape through the openings into channels formed between the casting box and the outer casing. These channels are constructed in such a way that they do not interfere with the flanges which are provided in order to centralize the casting-box with the casing.

The drawing shows the position of the tube which is being cast, in relation to the flask; this tube being shown in solid black section. At each end of the flask is a cover which can be removed when the box is being lined with sand or when the tube which has been founded is removed from the mold. As the box is slightly conical and has a very even surface, the tube can be removed without the mold being divided into two parts along its diameter. At each end of the whole revolving arrangement is provided a pouring channel through which the metal is introduced into the box. At the top of the longitudinal section will be noticed two pieces acted upon by spiral springs fixed in the casing; these pieces being hinged to the casing as shown in the cross-section. It will be noted that one of the flanges giving support to the inner casing of the flask bears against this hinged piece; the object of the arrangement being that if it is inconvenient to remove the cast tube before the heat of the molten metal within causes it to expand, the spiral springs yield to a sufficient extent and prevents the box from becoming jammed in the casing or breaking it. It is then possible by unscrewing the nuts to relieve the pressure sufficiently to enable the casting box to be removed.

The casting box and outer casing are revolved by means of a toothed or

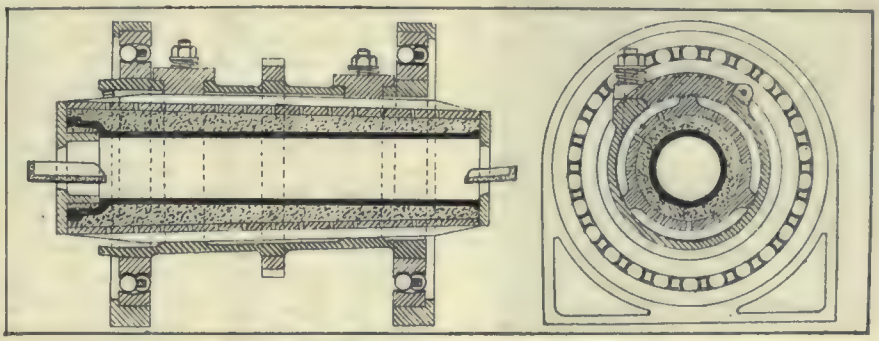


Fig. 1—Rotary Pipe-Casting Mould.

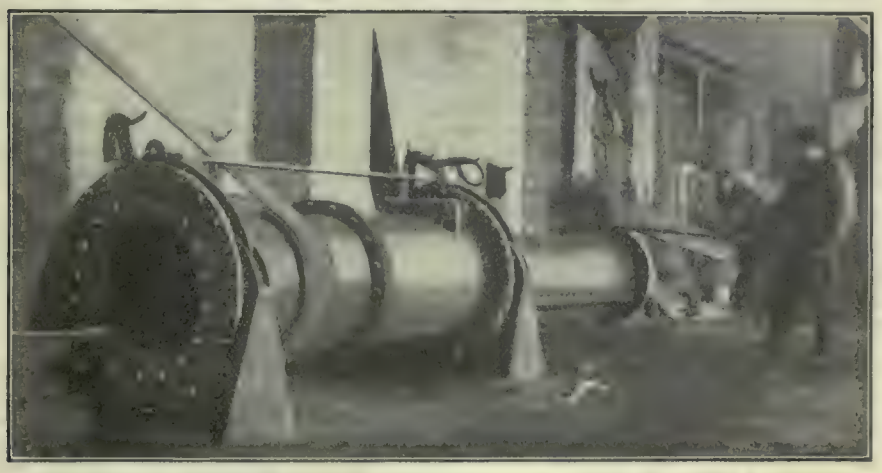


Fig. 2—Pipe Casting Machine, showing introduction of the Casting Box.

sprocket wheel fitted on the casing, or by means of a pulley, while suitable gearing is provided for the purpose of applying motive power. The casting box is charged and lined with fresh moulding sand for each casting operation, therefore, different types of tubes, as, for example, socket tubes, tubes provided with longitudinal and transverse ribs, and tubes with fixed end flanges can be easily manufactured by changing the pattern. Moreover, by using interchangeable casting boxes there is no time for the box to become so hot before the changing operation that it heats the outer casing. For this reason it is possible to use ball or roller bearings for the purpose of rotating the mold. The advantage in making the construction slightly conical will be seen when it is remembered that whilst the casting box is being dried its material is heated to a greater or less degree, and it therefore increases slightly in size.

Fig. 3—Sections of Pipes.

It is found in practice that the temperature of the casting boxes can never be so carefully regulated that they always have the same size when pushed into the outer casing; because one box may have a temperature of 150 deg. Cent., while another may be cold. As all the boxes and the outer casing have the same cone angle, however, the former can be centralized under all circumstances, the only difference being that a cool box can be inserted into the outer casing further than one of higher temperature.

### Molinder Process—Operation.

In operation, the mold is revolved at a speed great enough to make the centrifugal force sufficient to throw the iron outward as fast as it is poured, and in such manner that it flows out, and produces a more even thickness than it is possible to obtain by other methods. Ramming up the flasks is performed in the usual manner, except that great care has to be taken to have the pattern well centred. When casting pipe by this centrifugal method, it is sufficient to run the mold at such a speed that the centrifugal pressure exerted by the molten iron against the walls of the mold is about equal to that of an iron column 8 in. high. This pressure can be easily withstood by green sand, and it has been found by experiment with such molds that with good refractory sand the pipes come out just as smooth as with dried molds.

Putting in, casting, and taking out the flask by the method described above takes about eight to ten minutes, and about twenty to thirty minutes after pouring, the flask will have expanded sufficiently from the heat to drop the sand and casting when it is hung vertically with the wide end downward. When this has taken place the flask goes back to the ramming pit. It should be mentioned that the flask is taken out of the machine about four or five minutes after pouring. If slag or sand enters the mold when the iron is being poured, it separates to the inside of the pipe, because it is of less specific gravity than the iron itself. This is a most important feature, because owing to its position it can be scratched loose by a suitable tool about two minutes after pouring, while the mold is still in motion, thus ensuring a clean casting. Pipe founders will appreciate this, inasmuch as it is always found that some slag will separate from the iron, although apparently quite clean when poured.

Fig. 2 gives a photographic representation of one of these pipe-founding machines, with the casting box just being introduced. From this, the general arrangement will be observed. The iron before pouring must, of course, be weighed and measured. This is usually performed as follows:—When pouring a number of pipes of the same size, the first ladle, when it contains a sufficient amount of iron, is weighed and a mark put on the ladle, by means of which it can always be judged when there is sufficient iron in it. In taking the iron directly from the blast furnace for casting purposes, the greatest trouble, generally found, is that the iron contains more graphite than it can hold, causing unsound castings. It appears reasonable, however, to suppose that the centrifugal method will do away with this trouble when casting pipes, since all light particles separate to the interior. After the iron is poured, the graphite can be seen in the pipe; it having an appearance like red-hot dust, while the whole pipe is still fluid. Since all slag and dirt in such pipes separate to the inside surface, the iron must of necessity becomes more homogeneous than in pipes cast in the usual way. Figs 3 and 4 show specimens of fractured pipes, evidencing great regularity of cross- section.

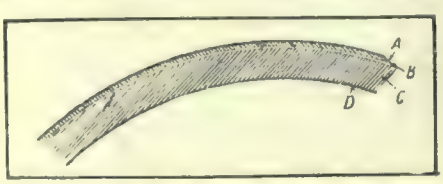



Fig. 5—Section of Pipe.

### Tests and Analyses.

A number of tests and analyses have been made on these products. Four pipes, each of 9 ft. 10 inches long, 7 7-8 inches in diameter, and 13-32 inch thickness,

Fig. 4—Fractured Pipes, showing even section

were tested at an hydraulic pressure of 50 atmospheres, or, say, 750 lb. to the square inch, without leaking or sweating being detected. Pipes cast in the ordinary way, when tested to a pressure of 20 to 30 atmospheres will show, usually, a good deal of leaking and sweating, due to their lack of homogeneity, brought about by the presence of slag and graphite. Table I. gives results of seven different analyses made on the same pipe. This should be studied with reference to the sketch, Fig. 5, illustrating a section of the pipe. It will be seen in the sketch that three different layers are indicated, but they are not quite so sharply marked in the actual castings as here shewn. Analysis No. 1 is taken in the layer marked A; Nos. 2 and 3 are taken in B; while Nos. 4, 5, 6, 7 refer to samples taken in succession towards the inside surface, and in such a way, that No. 7 is the inside surface when the skin was turned off.

The cast iron used did not contain more graphite than it could hold when cast in the ordinary way, but when using the centrifugal methods, it will be seen by the analyses that some of the

graphite is proceeding towards the inside of the pipe while the iron is still fluid. The seventh analysis, however, shows less graphitic carbon than Nos. 5 and 6; probably because of the fact that the inside skin or surface solidifies a moment or so earlier than the iron underneath it, which still continues to gather some graphitic carbon against the skin thus formed.—The Engineer.

TABLE I.

| No. | CC. | GC. | Si. | Mn. | P. | S. |
|---|---|---|---|---|---|---|
| 1 | .21 | 2.61 | 2.49 | .47 | 1.35 | .095 |
| 2 | .30 | 2.51 | 2.45 | .44 | 1.32 | .092 |
| 3 | .31 | 2.55 | 2.49 | .45 | 1.34 | .095 |
| 4 | .23 | 2.65 | 2.47 | .47 | 1.32 | .10 |
| 5 | .13 | 2.79 | 2.53 | .48 | 1.33 | .10 |
| 6 | .11 | 2.91 | 2.47 | .49 | 1.35 | .10 |
| 7 | .11 | 2.76 | 2.49 | .52 | 1.33 | .10 |

## A. B. JARDINE & CO., HESPELER, ONT.

A. B. JARDINE & CO., Hespeler, Ont., entirely re-modelled their plant recently and added a new machine shop and foundry. These have now been in full operation for several months and give employment to about 50 men. The firm are perhaps best known as makers of high-class taps and dies of all kinds, standard and special. They also make bolt threading machines, tube expanders, blacksmith and carriagemakers' tools and machines. A full set of jigs and similar appliances has been got up for the various lines manufactured, so that all like parts are absolutely interchangeable, as was conclusively demonstrated to us on the occasion of a recent visit. To the foundry must be given a large measure of the credit because the accuracy and smooth finish given to all castings is remarkable. Mr. John Jardine, the superintendent, is decidedly of the opinion that a little extra money spent in the foundry is more than repaid in the machine shop, especially in a plant turning out much repetition work.

### The Machine Shop.

The new machine shop covers a space of 90x60 feet, and consists of three bays. It is exceptionally well lighted by numerous windows and by a clerestory roof over the centre bay. Artificial lighting is secured by 100-watt tungsten lamps suspended from the roof trusses, in addition to which ordinary carbon lamps are suspended over each machine. The machinery equipment is of an interesting and up-to-date description and shows ample evidence of being well cared for. A somewhat unusual machine to be seen here is a combined turret and engine-lathe built by Stevens & Hamilton—now the Stevens Company, of Galt. This lathe has a bed 10 feet long and is fitted with an ordinary apron, so that it can, when necessary, be used as a 20-inch engine lathe; the turret being then used to carry the tailstock centre. It is used chiefly for boring and chuck work.

The largest lathe in the shop is a 28-in. by 12 feet, McGregor-Gourlay engine lathe, which, by means of an extra countershaft operated by a clutch, makes it practically the equivalent of a double back geared lathe. All special taps are threaded on a Hendey 16-inch tool room lathe, fitted with quick change speed gears and relieving attachment. The chasing is done with a Rivett-Dock threading attachment. In the case of tapper taps, pulley taps, etc., an economy is effected by welding-on the shank in a Toledo electric welder having capacity up to 7/8-inch diameter. By changing the die points, the machine can be used for spot welding, and is so used for attaching the fan blades to the hub or spider of a very popular forge blower manufactured by the firm. Near this welder stands a Landis No. 3 universal grinder, fitted with internal grinding attachment.

Situated about the middle of the shop are several engine lathes designed many years ago, but still doing good work. As proof of this, we may cite the case of a 20-inch McKechnie-Bertram tool which forms one of the group. This lathe, about 30 years old, was lined-up and overhauled 3 years ago. Its condition is so good that it is always used when it becomes necessary to cut new lead screws for the automatic tap lathes hereafter mentioned. In doing this job, the ordinary lead screw is removed from the McKechnie lathe and a special precision lead screw substituted. The latter was supplied by Brown & Sharpe under a guarantee that the error would not exceed .003 inch in any 3 feet and would not be cumulative. Special gears drive this screw. These are designed to slightly lengthen the pitch of the head screw being cut. In this way the pitch of the taps is increased the correct amount to allow for shrinkage in hardening. Other machines in the centre bay include a Hendey 18-inch by 10 feet engine lathe and three 22-inch drill

THE PLANT OF A. B. JARDINE & CO., HESPELER, ONTARIO.

presses with sliding heads. One of these is by John Bertram & Sons, the other two being built by W. F. & J. Barnes. Bolted to a column nearby is an ingenious three-spindle drill. This was designed and built by A. B. Jardine & Co., and occupies very little space. The heads are arranged in a circle, and by means of an indexing arrangement any one of them may be brought into line with the driving spindle, which is then brought down and drives it by means of a small dog tooth clutch.

Further equipment to be noticed includes:—Three milling machines, one of which—a plain miller by Stevens & Hamilton—has been in continuous use for close on twenty years and during that time has only had the table and slides scraped and adjusted once. This speaks well for the construction of the machine and also for the care it has received in use. The other milling machines comprise a No. 2 Leblond universal and a No. 7 Becker-Brainard (Lincoln type) machine. The latter is used for milling flutes in taps. It has a special attachment for holding four taps at once, an independent cutter operating on each tap. There is an indexing arrangement by means of which, after the first flute is milled, the taps are simultaneously revolved through the correct angle for cutting the next flute. All taps, except specials, are chased on automatic tap lathes designed and built by the firm. There are five of these lathes, one operator attending to all of them. The taps are sized by Brown & Sharpe thread micrometers, which give the pitch diameter in the thread and are made within a limit of .0005 inch. These lathes, as well as other machines throughout the shop, have the work flooded from a common pipe system through which oil is forced from an underground tank by a small centrifugal pump.

All gear cutting is done on an automatic gear cutter made by the E. J. Flather Mfg. Co., Nashua, N.H. This will cut a gear 30 inches diameter by 9 inches face. Near this stands a 24x30 planer having an 8 feet bed, built by the London Machine Tool Co., and chiefly used for broaching, since the various lines manufactured call for very little planing. A Bertram 24-inch shaper and two power hack saws complete the list of the machine tool equipment; but in addition, there are several grinding and polishing stands for sharpening taps, polishing dies, etc., the dust from these being carried off by hoods and exhaust fans. The taps have the size, trade mark, etc., stamped on them by a marking machine built by the Dwight Slate Machine Co., Hartford, Conn. At one end of the shop is a small electro-plating plant in which die stocks are nickel-plated.

All machines are belt-driven from line shafting, running in ball-bearing hangers designed and made by the firm, the shafting being driven by several motors taking hydro-electric power.

### The Hardening Process.

Taps, dies and other tools are hardened in a coal heated muffle, the temperature of which is checked by a Foster fixed focus pyrometer. On reaching the proper heat the tools are quenched in water kept at an even temperature by means of a circulating pump. They are afterwards tempered in an oil bath, the oil being heated in a copper vessel over a coal fire. When the thermometer in the bath shows the correct temperature, the taps, etc., are dipped into the oil in wire baskets and when heated, are cooled off in cold oil. Adjacent to the hardening room is a small blacksmith shop containing one fire and a 400 pound steam hammer by B. & S. Massey, Manchester, England.

### The Foundry.

The new foundry employs five moulders at present, and as already mentioned, turns out some finely finished work. Large numbers of bevel and spur gears are moulded on a stripper plate moulding machine designed and built by the firm. A 28-inch Collian cupola is used and at present the largest casting made weighs 800 pounds. This is the casting for the firm's well-known 25-pound power hammer, which has proved so successful that patterns are now being got out for one of double the size.

Messrs Jardine & Co. supply a large number of taps, dies, etc., to the Grand Trunk and other railways and large manufacturing plants, while their hand drilling machines, tire upsetters and benders and other tools are in request amongst blacksmiths and wagon builders. Their Western trade is also extensive, not infrequently necessitating complete carload shipments.

## OIL BATHS FOR GEAR BOXES.

AN interesting sidelight is thrown on the question of flooded lubrication for machine tool gear boxes in the following communication to Page's Weekly by F. W. S., Disbury, Manchester, England:—

A new machine driving through a geared driving box was undergoing efficiency tests. All the gears on the lower shaft of the driving box dipped into oil, contained in the lower part of the box. In testing, the splash of oil was so great that the force was sufficient to cause leakage at various joints. As a consequence, it was decided to carry on the test with a lowered oil surface. After completion of the test, which was to ascertain the power necessary to effect certain cuts, an examination of the power curve showed a big discrepancy, and this discrepancy appeared at the very point at which the change in oil surface had been made; hence it was decided to duplicate the tests last made, after replacement of the oil to bring it to the former level. The power figures were now found to increase from about 10 to 20 per cent., according to the speed, the conclusion drawn being that the additional oil resulted in this amount of loss.

Finally, tests were made to show the differences caused by varying the oil level, even to the extent of suppressing the splash altogether, with the result that the power needed was seen to increase uniformly as the oil level was raised. There is no doubt the extra power was entailed by the additional work to be done in moving the oil, all the gears acting, as it were, as pumps, and taking the power that a pump would require to do the same amount of work. After running some little time entirely without oil, power was found to increase, and examination showed that temperature at the bearings gradually increased. As a result of the tests, it was decided to reduce the oil level to the minimum requisite to ensure efficient lubrication, with an average saving in power of some 15 per cent.

Does not this suggest a return to some form of syphon or drip lubrication? A constant loss of, say, but ½ h.p. is a matter deserving of some little consideration and would well pay for the little additional cost of fitting special means for lubrication, and the trouble entailed in daily oiling.

## DANGERS OF THE CASTING SHOP.

THE following notice which is framed and posted in the foundry of C. Cowles & Co., New Haven, Conn., should be of interest to foundrymen in general:—

When a person is burned by molten brass, if a slight burn, wash it first with a warm solution of a mixture of 50 parts of water, containing 2 per cent. of carbolic acid, and 50 parts of a strong solution of sodium carbonate. After the pain has subsided, a bandage should be put on saturated with a mixture of 80 per cent. strong lime water and 20 per cent. boiled linseed oil. When the blister that forms has broken or been reduced, the burn should be dressed with hydrogen peroxide diluted with one-half water. The wound will then heal. If

the burn is serious, call a physician, and pending his arrival, apply the carbolic acid and soda solution to the burned parts as gently as possible, and leave the rest of the treatment to the doctor.

### CENTRAL RAILWAY CLUB OUTING.

THE fifth annual outing of the Central Railway and Engineering Club of Canada, took place on Saturday, June 22nd last, when about 150 members left Toronto by special train for the little town of Erin, Ont. Favored by magnificent weather, the excursion proved most enjoyable to all present. The train certainly broke no records on the outward journey, so that everyone was in fine shape for dinner by the time Erin was reached. In the afternoon a good programme of sports was carried out in the Stanley Park. a picturesque pleasure ground near the station. The chief item was a baseball match between teams representing the Mechanics and the Pedlars, for a silver challenge cup. The Pedlars won (8-6) thus reversing last year's result. Quoit matches, foot races, sculling matches on the lake and other events completed a well-contested programme, at the conclusion of which handsome prizes were distributed to the lucky winners. A band was in attendance and enlivened the proceedings with the latest airs.

### C.P.R. ELECTRIFICATION.

The electrification of the Rossland division of the Canadian Pacific Railway in British Columbia is being pushed forward to determine the applicability of such a course under the heavy conditions to be encountered. The section to be electrified runs from Rossland to Castlegar Junction. The length of the Rossland division is 29.3 miles, which, with sidings and yard trackage mounts up to a total trackage of 43 miles. The motive power installation will consist of four 70 to 80-ton electric locomotives; power being obtained from the West Kootenay Power and Light Company at probably 60,000 volts. This will be utilized through motor generator sets in sub-stations located either at Trail or Smelter Junction. Systems using alternating current at 6,600 volts and direct current at 2,400 volts are being proposed.

**Mr. Thomas Black**, of Winnipeg, is negotiating with the authorities of Fort William to secure concessions for the erection of a wire and nail plant to cost between $150,000 and $200,000 and give employment to about 200 men. An option on a site has been secured, but the details of the agreement to be made with the city have not yet been arranged.

## Trade Gossip.

**The Eastern Car Co.**, organized as a subsidiary of Scotia to make steel cars, was organized at New Glasgow recently by directors of Nova Scotia Steel and Coal Co., and others. The capital is to be $250,000, and the plant will be constructed in New Glasgow with an initial capacity of twenty-five cars a day, giving employment to one thousand men. A former official of the American Car and Foundry Co. has been secured as manager. The new plant will be the third car works in Nova Scotia. All the capital was underwritten within two hours.

**The Russell Motor Car Works, Toronto**, are building another extension to their present plant on Weston Road South. A permit has been issued for the erection of a four-storey machine shop to cost about $10,000. The new building will be about 170 feet long and 60 feet wide, and will be situated just east of the new office building. The total cost of the equipment and building will be about $100,000.

**The Smart-Turner Machine Co., Hamilton, Ont.**, have recently received the following orders:—R. M. Breckenridge, Burlington, Ont., triplex power pump; Geo. Frid & Son, Hamilton, Ont., duplex pump; Wettlauffer Bros., Mitchell, Ont., centrifugal pump; Joseph Battle, Thorold, Ont., duplex pump; the Western Construction Co., Courtright, Ont., duplex pump; Corporation of Dauphin, Dauphin, Ont., underwriter fire pump; the Wolverton Milling Co., Wolverton, Ont., rotary fire pump; The Hamilton Gaslight Co., Hamilton, Ont., duplex pump.

**Swedish Steel and Importing Co.**—Lammers & Carleson announce that they have assumed as a partner, Mr. O. Bergstrom, metallurgist and consulting mining engineer, and that the firm name has been changed to that of the Swedish Steel and Importing Co., Ltd., with head office in the Canadian Express Building, Montreal.

**The Foss & Hill Machinery Co.**, 344 St. James Street, Montreal, have been appointed agents in their territory for the Detroit Twist Drill Company. A large and complete stock of all kinds and sizes of the well known "Detroit" brand of twist drills, reamers, cutters, etc., will be carried, facilitating prompt delivery, and especial service in the actual use of these well known tools that an exacting purchaser will appreciate. Attractive booklets illustrating and describing "Detroit" Drills, including some very practical information governing their use will be mailed by the Foss & Hill Machinery Company to inquirers.

**Dominion Steel Corporation.**—Mr. J. H. Plummer announced that the Dominion Steel Corporation will start the manufacture of nails. By putting the wire rods through this finishing process, the task of competing with duty-free wire rods from the United States is overcome, as nails come under the protection of the present tariff.

**The Capital Wire Cloth & Mfg. Co.** advises that its plant in Ottawa, Can., is being erected and it expects to occupy it an an early date. It is the plan of the company to be turning out its finished product, consisting of Foudrinier wires and paper mill wire cloth of every description, about July 20. The output will be for the Canadian trade. The building is to be of silicate brick construction, two storeys, 42 x 100 feet, and large enough to accommodate twelve looms. The building will have a blind end so that it can be conveniently added to as occasion demands. The company has the following officers: President, J. R. Buchanan; vice president, Frank Haefs; secretary and treasurer, J. W. Perazzo; superintendent, M. L. Peebles. They, with William Buchanan, constitute the directorate. All members of the company have been connected with the Appleton Wire Wks., Appleton, Wis., for periods ranging from five to sixteen years. William Buchanan is general manager of the latter concern.

**The Page-Hersey Co.**, who have taken over the agreement made between the Corporation of Fort William, Ont., and F. V. Samwell regarding a tube works, intend commencing construction operations on a plant in the course of a few weeks.

**The Imperial Steel & Wire Co.**, Collingwood, Ont., has converted $300,000 of its unsubscribed capital stock into cumulative preferred stock bearing 7 per cent. interest and ranking pari passu with the stock already issued. During the last three years the capacity of the plant has been increased from 15 tons to 40 tons of finished wire product daily.

**The Canadian Morehead Mfg. Co.** has been organized, with headquarters at Woodsteck, Ontario. Return and non-return vacuum traps and condensers will be manufactured. G. H. King, Woodstock, is president and general manager.

**The Canadian Boomer Boscher Press Co., Ltd.**, are making large additions to their plant in Montreal, which step has been rendered imperative by the large increase in business. The extensions comprise an addition 160 ft. long by 40 ft. wide to the machine shop; a new boiler house and a new blacksmith shop. The extensions will give the company large and improved facilities in all branches of their manufacturing and will naturally greatly increase the output.

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Montreal, Que.**—Mr. W. W. Butler, Vice-President of the Canadian Car & Foundry Co., who has just returned from the coast, announced that his company would locate a branch in the vicinity of Vancouver. The Pacific coast plant will not be as large as the Fort William one, though the probable cost will be one million dollars.

**Montreal, Que.**—The plant of the Peck Rolling Mills was recently damaged by fire to the extent of $25,000.

**Toronto, Ont.**—The Canada Foundry Co., Lansdowne and Royce Avenues, Toronto, is erecting a foundry for the production of ornamental iron castings, at a cost of $110,000.

**Ottawa, Ont.**—What promises to be one of the largest plants of its kind on the continent is about to be built here in the form of new car works. The foundry will occupy about 120 acres.

**Fort William, Ont.**—The Fort William and Canada Car & Foundry Company expects to be operating in about fifteen months hence, and will then employ some thousands of men. The foundry will have a yearly capacity of about seven thousand cars.

**New Glasgow, N.S.**—The Eastern Car Foundry Company, Limited, have organized for the purpose of manufacturing steel underframes. The company is capitalized at $2,500,000, and will employ about 1,000 men.

**Nokomis, Sask.**—W. F. Terry has just opened his new garage and machine shop on Fifth Avenue. The shop has a large quantity of new machinery installed, and will be modern in every respect.

**Toronto, Ont.**—Fire broke out in the pattern shop of the Berg Machinery Company, on Bathurst Street, and did considerable damage before being checked.

**Portage la Prairie, Man.**—A fire recently destroyed the entire mechanical shops and storerooms of the Grand Trunk Pacific Railway, situated about a mile from here. Total loss was $50,000.

**Welland, Ont.**—The Canadian Steel Foundries Company is making a big addition to its plant here. The number of employes will be increased to 600, it is expected. The contract is held by the Hamilton Bridge Company.

**Saskatoon, Sask.**—The Saskatoon Motor & Machinery Works has been opened here. The organizers are said to be experienced machinists, and intend to develop an up-to-date shop.

**Hamilton, Ont.**—It is reported that the Steel Castings Syndicate will locate here and erect a foundry to cost $300,000, and to employ 400 men. The company is backed by Toronto, Hamilton, Brantford and Buffalo capital.

**Prince Albert, Sask.**—A fire, the cause of which is unknown, destroyed the plant of the Prince Albert Foundry Company here to the extent of $17,000. Insurance, $2,500.

**Gananoque, Ont.**—The Spring & Axle Company propose improving the shop to the extent of $10,000. When work is finished automobile springs will be manufactured.

**Welland, Ont.**—Plans are prepared for an extensive addition to the Page-Hersey Pipe Mills here. Pattern and pattern storage shops will be constructed, and contracts for same will soon be let.

### MUNICIPAL.

**Bracebridge, Ont.**—Two by-laws were recently endorsed by the ratepayers. They provided for the raising of $5,000 re reservoir, and $7,000 for spring water extension respectively.

**Barrie, Ont.**—The Hydro-Electric by-law was recently sanctioned by the ratepayers. A by-law to raise $7,000 for extension of the Barrie electric light plant was also passed.

**Waterloo, Ont.**—The by-law to grant $10,000 as a loan to Chas. Kreutziger re erection of a box factory was carried by a majority.

**Regina, Sask.**—The ratepayers refused to sanction the bonus to the Ontario and Manitoba Flour Mills Company. By the proposed scheme the city was to guarantee the company's bond to the extent of $200,000.

**Battleford, Sask.**—The ratepayers sanctioned two by-laws recently. They provided for the raising of $100,000 for electric light extension, and $50,000 for building of sidewalks.

**Wainwright, Sask.**—The burgesses recently endorsed a by-law to raise $25,000 re erection of a flour mill.

**Caledonia, Ont.**—The Hydro-Electric Power by-law was passed by the ratepayers recently.

**Coldwater, Ont.**—The ratepayers voted in favor of the Hydro-Electric by-law recently submitted.

**Minnedosa, Man.**—The burgesses passed a by-law to raise $40,000 as a guarantee for the bonds of the Minnedosa Power Company.

**Medicine Hat, Alta.**—The by-law calling for the expenditure of $4,200 for industrial sites was recently approved by the ratepayers.

**Port Arthur, Ont.**—The burgesses recently passed the following by-laws:—$1,400 re street railway improvement; $11,500 for laying steel rails on the Fort William road; $15,000 for electric light extension; and $19,000 for a site for a public market.

**Exeter, Ont.**—The ratepayers recently endorsed by-law placed before them to raise $5,00 for the improvement of the sewerage system.

**New Westminster, B.C.**—The ratepayers have voted $400,000 for road and waterworks extensions and city enterprises.

**Outremont, Que.**—The by-law authorizing the council to borrow $400,000 was sanctioned.

**Perth, Ont.**—A by-law to loan the Perth Shoe Co. $25,000 was defeated by the ratepayers.

**Eganville, Ont.**—The Ontario Government will purchase $11,500 of debentures for school purposes.

**Chilliwac, B.C.**—The sewerage by-law which involved the loan of $75,000 was defeated whilst the following by-law was passed: Waterworks $144,000.

**Niagara Falls, Ont.**—The by-law appropriating $3,000 to purchase site for Pollard Machine Co. was passed.

**Fergus, Ont.**—The burgesses voted in favor of the Canadian Cereal Co. by-law, also in favor of the waterworks by-law.

**Woodstock, Ont.**—A majority voted in favor of the by-law to grant a loan of $3,500 to the Woodstock Automobile Manufacturing Company.

**Regina, Alta.**—The ratepayers carried by-law to raise $25,000 for publicity purposes.

**Blyth, Ont.**—The burgesses ratified by-law to grant a loan of $5,000 to the Blyth Flax Mill Co.

**Macleod, Alta.**—The by-law empowering the town to borrow $100,000 for municipal building was approved of by voters.

**Port Dalhousie, Ont.**—The by-law calling for the raising of $10,000 for electric lighting system was recently endorsed by the ratepayers.

**New Hamburg, Ont.**—The by-law granting a loan of $20,000 to the Electrical Specialties Company, was recently sanctioned by the ratepayers.

**Amherstburg, Ont.**—The ratepayers voted in favor of the loaning of $10,000 to the new automobile company and the new knitting factory just starting operations.

**Nanaimo, B.C.**—The ratepayers defeated the waterworks extension by-law which called for the expenditure of $15,000.

**Lethbridge, Alta.**—The burgesses recently endorsed the following by-laws:—$40,000 for electric light extensions; $10,000 for street railway; $25,000 for firehall, etc.; $39,000 re purchase of road roller; $83,000 re sewage system; $42,000 waterworks extension.

**St. Johns, Que.**—The ratepayers recently endorsed a by-law granting $10,000 to J. P. Mennier and J. Deneault as a bonus to a jewelry and plated ware manufacturing concern about to be started by them.

**Port Arthur, Ont.**—The ratepayers have passed a by-law whereby the city will buy 33 per cent. of the shares of the car manufacturing company about to commence business here.

### ELECTRICAL.

**Battleford, Sask.**—The sum of $100,000 will be spent in the near future upon the extension of the electric light system here.

**Galt, Ont.**—The extension of the Hydro-Electric system here is being considered by the citizens. The cost of completing system will be about $45,000.

**Grand Forks, B.C.**—The British Columbia Copper Co. will shortly install an electric motor at Rawhide mine, at Phoenix.

**Barrie, Ont.**—The Barrie electric light plant is to be extended soon, as $7,000 was recently voted for that purpose.

**Galt, Ont.**—The ratepayers will vote on a by-law to raise $45,000 to complete the hydro-electric system of the city.

**Lethbridge, Alta.**—The sum of $40,000 will soon be expended for the extension of the electric lighting system here.

**Minnedosa, Man.**—The bonds of the Minnedosa Power Company have been guaranteed to the extent of $40,000 by the citizens here.

**Coldwater, Ont.**—The Hydro-Electric system is about to be installed here.

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**C.N.R. Repair Shops.** — The office of chief engineer of the Canadian Northern Railway is engaged in the preparation of plans of the proposed railway repair shops and roundhouse to be erected this summer at Fort Mann. The repair shops will be 200 feet long and will be equipped with modern machinery. They will adjoin the round house which will have accommodation for fifteen locomotives. The material to be used in construction will probably be reinforced concrete.

**C.N.R. Extensions.** Sir William Mackenzie recently announced important road extensions for the future. Chief among these are the future plans of the Canadian Northern Railway for Ontario and Toronto. The president of the road stated that improvements to be made in the vicinity of Toronto will amount to many millions of dollars. They will include new yards and shops at Leaside Junction, and a new office building in Toronto, where the head quarters of the company will be situated. This will be one of the handsomest buildings in Toronto.

**B.C. Merger.**—The Schaake Machine Works, for many years one of New Westminster's foremost industrial enterprises, recently lost its identity when it merged with Heap's Engineering Works, of Vancouver. Mr. Heaps declined to make any statement as to the location of the plant, which it is understood will be considerably enlarged. No site has yet been determined upon.

**Government Bounties.**—The Dominion of Canada paid bounties for three months of last year, amounting to $300,000 on steel, lead, petroleum, etc.

**Mr. Herbert K. Scott, M.I.M.E.,** of London, Eng., has sailed for Newfoundland on professional business.

**Mr. E. Holt Gurney,** of the Gurney Foundry Co., Toronto, Can., is on a three months' pleasure and business trip to Europe.

**Caledonia, Ont.**—The Hydro-Electric system by-law recently received the assent of the ratepayers, and preparations for its installation will soon begin.

### PLANING MILLS AND SAW MILLS.

**Nelson, B.C.**—The receivers of the Yale-Columbia Saw Mill Company have decided to rebuild the mill which was burned down recently.

**Bobcaygeon, Ont.**—The Bobcaygeon saw mill was recently destroyed by fire, caused by lightning. The building was insured at $1,200, but this does not cover loss fully.

**Galt, Ont.**—Mr. Bailey has bought the old Scott planing mill on Ainslee Street, and new machinery will be installed, and the plant will be made up-to-date in everyway.

**Coquitlam, B.C.**—The Vancouver Timber & Trading Company has purchased a site for the modern saw mill they propose to erect near here. The capacity of mill will be about 200,000 feet per day.

**Penetanguishene, Ont.**—The saw mill of the C. Deck Company here was recently wiped out of existence by fire, believed to have been caused by an overheated bearing in engine house.

**Nelson, B.C.**—Fire recently destroyed the lumber mill of J. B. Winsaw, near here, the total loss of which is estimated at $50,000. No insurance.

**Fredericton, N.B.**—Moses Haines has erected a saw mill near mouth of Nashwaaksis, and will soon begin operation.

**Lindsay, Ont.**—Fire recently did damage to the extent of $3,000 to the planing factory owned by the Jones Hardware Company. Loss is partly covered by insurance.

**Humboldt, Sask.**—The Carberry Planing Mills Company have just completed negotiations whereby the company will erect a modern planing mill.

**Lacombe, B.C.**—The planing mill of the St. Paul & Tacoma Lumber Company was damaged by fire to the extent of $250,000. The loss is partly covered by insurance.

**Byng Inlet.**—Two saw mills of the Graves, Bigwood & Co. here were recently destroyed by fire. The mills are said to be among the finest in Canada, and their loss is keenly felt by citizens who are dependent upon them.

### GENERAL MANUFACTURING.

**Milverton, Ont.**—Messrs. Hendrich and Lydt have been granted concessions by the ratepayers on the understanding that they will erect a large furniture factory. Building operations will begin at once.

**Cobalt, Ont.**—It is reported that M. J. O'Brien, of Renfrew, will build a 400-ton per day pulp mill. Land has been acquired and work is likely to commence at once.

**Toronto, Ont.**—The Canada Brick & Fireproofing Co., Ltd., have secured a charter from the Ontario Government, and will begin operations at once. It is capitalized at $500,000.

**Berlin, Ont.**—The Consolidated Rubber Co., Ltd., proposes to erect a factory here for the manufacture of automobile tires.

**Windsor, Ont.**—The National Auto Body Co., Ltd., which has been organized with $150,000 capital, is to construct a plant here, and are calling for tenders for same.

**Coquitlam, B.C.**—The Dominion Match Co. is about to erect here one of the largest and best equipped factories on the Pacific Coast.

**Welland, Ont.**—The grist mills known as the Brown's Mills, owned by R. Cooper, suffered loss through fire to the extent of $15,000.

**Ottawa East, Ont.**—The Ottawa Gas Co. has decided to build an auxiliary plant here, and six large gasometers will be installed at once, and all other requisites to make a thoroughly modern gas works.

**Windsor, Ont.**—A new automobile factory is about to be started here by the State Electrics, Limited. Temporary premises have been secured and a permanent plant is to be erected within a few months.

**St. Thomas, Ont.**—George Doolittle has purchased the buildings and plant of the St. Thomas Canning Company, and will use it for the extension of his trade in evaporated apples.

**New Westminster, B.C.**—The Royal City Mills here were recently destroyed by fire, and damage to the extent of $50,000 was done.

**Park Hill, Ont.**—The mill of the Park Hill Flour Company was a few days ago destroyed by fire. The loss is $15,000, partly covered by insurance.

**Fort William, Ont.**—The Great West Wire Fence Company are about to locate a factory here, and details will be announced later.

**Harriston, Ont.**—Francis Burns, of this place, is about to start up a factory for the manufacture of cheese cutters, cheese cases, refrigerators, show cases and meat cutters.

**Leamington, Ont.**—In nearly every part of western Ontario the Dominion Canners will

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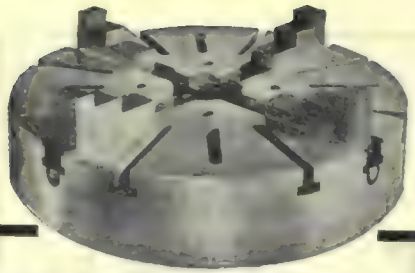

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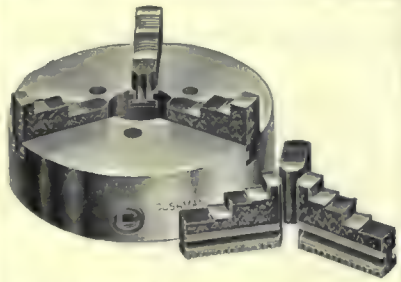
Old Material Bought and Sold.



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are generally known as the "heavy pattern" being designed for hard service.

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Our line consists of many styles and sizes of Lathe Chucks, Drill Chucks, Centering Chucks and Face-Plate Jaws.

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Hartford, Conn., U.S.A.
Established 1862

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**Simonds Canada Saw Co., Ltd.**
MONTREAL, QUE.
St. John, N.B. Vancouver, B.C.
*In the United States, Simonds Mfg. Co.*


either improve the plants now in operation or erect new ones in preparation for the busy seasons. New packing establishments will be erected at Ridgetown, Forest, Jordan and Font Hill, Ont.

**Belleville, Ont.**—The first sod for the erection of the Ogilvie mill here was turned recently. The mill is 53 by 183 feet, and will be six stories high. The warehouse will be 178 by 170 feet, and its receiving capacity will be about 25,000 barrels of flour. The whole plant will cost $750,000, and will probably be completed in six months' time. W. H. Tann is the general superintendent.

**Medicine Hat, Alta.**—It is reported that a million dollar cement plant is about to be constructed here by the Canada Cement Company. No details are given yet.

**Saskatoon, Sask.**—The Saskatoon Tent & Mattress Company propose establishing a factory here, and building operations have been started.

**Welland, Ont.**—The Canadian Cataract Rubber Company have applied for a charter of incorporation, and will locate for business here. They will manufacture automobile tires.

**Shoal Lake, Man.**—The harness factory of R. Greenwood & Son is about to be enlarged, and workmen are now engaged on the erection of an addition.

**Calgary, Alta.**—The Western Canada Stone Company is organized with a capitalization of $500,000. The enterprise will employ about 300 men in the quarries. Alderman J. G. Watson is managing director.

**Garden Hill, Ont.**—The woollen factory here was recently struck by lightning, and fire did damage to the extent of $10,000.

**Orillia, Ont.**—It is possible that arrangements will soon be made whereby James T. Arnold & Company will locate a factory here for the manufacturing of upholstering material.

**Sydney, C.B.**—The Steel Company here will have a new cooperage mill, which will manufacture kegs and barrels for packing nails. The mill will employ 150 skilled men and helpers.

**New Liskeard, Ont.**—Extensive plans for a large canning factory are being made by Brillinger & Lang, of this place. It is expected the factory will be completed by September.

**Colborne, Ont.**—The Ohio Motor Car Company of Cincinnati are about to locate a Canadian branch here. A by-law granting a free site and exemption from taxation was passed by ratepayers recently.

**West Toronto, Ont.**—Amongst the many buildings that are being erected by the Swift Canadian Company at their plant at the corner of St. Clair Avenue and Keele Street is a soap factory. The building, eight storeys high, will be built of concrete. This company will be the first of its kind in Canada to manufacture soap. A short time ago a cottonseed oil refinery was built north of the company's abattoir and at present the company are erecting a $250,000 cold storage plant on St. Clair Avenue. This structure is also constructed of reinforced concrete.

### BUILDING NOTES.

**Toronto, Ont.**—A new examining warehouse is to be erected here soon, to cost about $300,000. The exact site has not been selected yet.

**Calgary, Alta.**—A six-storey block, to cost $175,000, has been started here.

**Montreal, Que.**—Work has commenced here on the construction of two big structures on McGill Street, to cost about $1,000,000. Work is expected to be finished by April of next year.

**Thorold, Ont.**—The contract for the erection of the Ontario Pulp & Paper Mills has been let to Lackawanna Bridge Company of Buffalo. The mill will cost about $1,000,000.

**Edmonton, Alta.**—The Harvester Company are about to construct a warehouse which promises to be the largest of its kind in Western Canada. Details of the building are not given, but the cost will be about $250,000.

**Port Arthur, Ont.**—A ten-storey structure will shortly be commenced here. The new building, which will be one of the finest in Canada, will be used for business and commercial purposes.

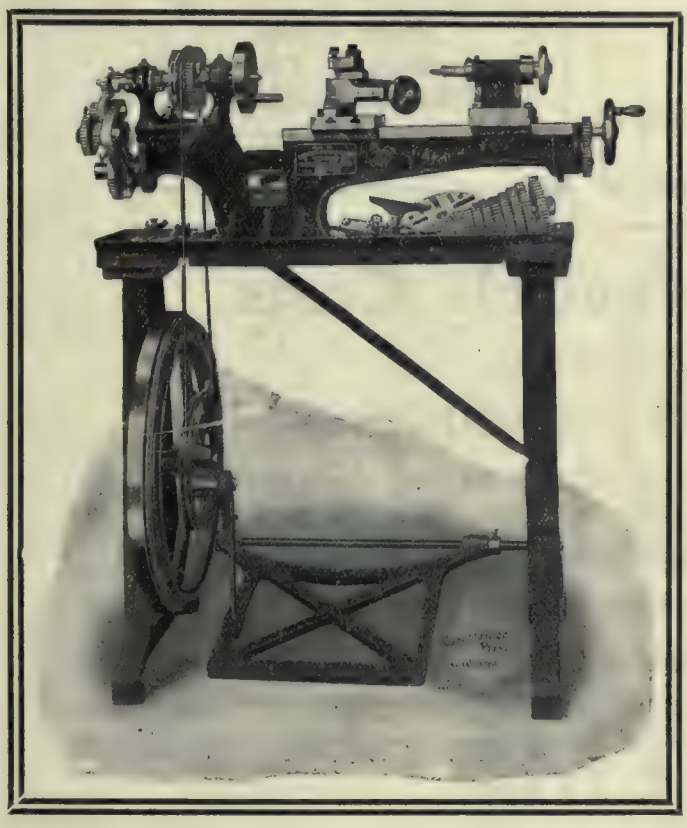
**Toronto, Ont.**—The Doherty Manufacturing Company has secured a permit to erect an $80,000 six-storey warehouse of brick and stone on Spadina Avenue.

**Wetaskiwin, Alta.**—The plans for the automobile factory are completed, whereby the Vulcan Corporation are to erect a brick structure of large proportions.

**West Toronto.**—The Russell Motor Car Company will shortly start the erection of a new $100,000 building here. It will be four storeys high and 170 feet long by 60 feet wide.

**The Canadian Boomer & Boschert Press Co.** of Montreal have sent us their latest bulletin on veneer presses. The bulletin has ex-

# A SMALL LATHE with a BIG REPUTATION



For Model-Making, Motor repairs and small Manufactures. Self-Oiling, Sliding, Boring, Screw-cutting. Back-Geared, Gap Bed, with Treadle or Countershaft.

| | |
|---|---|
| Height of centres | 3½ in. |
| Length of bed | 2ft. 6 in. |
| Lengh between centres | 1ft. 4 in. |
| Diameter of gap | 9½ in. |
| Length of gap | 4 in. |
| Diameter over saddle | 5½ in. |
| Weight | 300 lbs. |

PRICE
**$65**
at Works in England.

This lathe enjoys an enormous reputation in England, Australia, Tasmania, New Zealand, etc., and has been supplied to the British Admiralty, War Office, London County Council, etc., and a large number of civil firms.

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*TORONTO* (8)

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THE J.C. McLAREN BELTING Co. OAK EXTRA TANNED EST 1856

TORONTO MONTREAL WINNIPEG

ST JOHN N.B VANCOUVER

cellent illustrations of single and double power screw veneer presses of various types. A few of the hydraulic presses are also shown. On account of the vast number of types of these latter it is impossible to illustrate them all. Copies of bulletin C1 will be sent on request.

### CONTRACTS PLACED.

**Hamilton, Ont.**—The Des Moines Manufacturing Company, of Des Moines, Iowa, have received the contract to construct a water tower here, to cost $4,990.

**Ste. Therese de Blainville, Que.**—The work of installing a waterworks system to cost $75,000 for the Aqueduct Company of Blainville, Blainville, Que., is being done by the owners of the company under the supervision of Engineers Ouimet and Lesage, St. Lawrence Boulevard.

**North Battleford, Sask.**—The Canadian Westinghouse Company have received the contract calling for the supply and erection of a 500 kw. generator and equipment, the price being $5,580.

**North Battleford, Sask.**—Messrs. Laurie and Lamb have received the contract to erect and furnish a 750 h.p. steam engine, the price being $20,250.

**North Battleford, Sask.**—The contract calling for the erection and supply of a boiler has been awarded to Messrs. Babcock & Wilcox, Ltd., the price being $8,700.

**Point Grey, B.C.**—A $1,500 contract for the supplying of galvanized piping for use in extending the water supply system of the municipality has been awarded to Messrs. Robertson and Godson, of Vancouver.

### POINTERS FOR CONTRACTORS.

**Penticton, B.C.**—The council of this municipality will call tenders on a 200 h.p. Diesel engine to be used as motive power in the lighting plant of the town.

**Montreal, Que.**—Plans and specifications are being prepared by T. Pringle & Son, Ltd., engineers, Montreal, for extensions to reclaim plant for the Canadian Rubber Co. Montreal.

**Montreal, Que.**—Plans and specifications are being prepared by T. Pringle & Son, Ltd., for a new slasher house for the Dominion Textile Co., Hochelaga branch, Montreal.

**Montreal, Que.**—T. Pringle & Son, Ltd., are preparing plans and specifications for a manufacturing plant for the N. K. Fairbank Co., Cote St. Paul, Montreal.

**Three Rivers, Que.**—Plans and specifications are being prepared by T. Pringle & Son for a new cotton mill plant at the St. Maurice Valley Cotton Mills here.

**Toronto, Ont.**—The Canadian Fairbanks-Morse Co., Toronto, are planning the erection of a large tractor shop on their property at Bloor Street west, Toronto. The plans and specifications of this building are being prepared by T. Pringle & Son.

**Calgary, Alta.**—Ratepayers of Calgary will shortly be called upon to authorize the expenditure of $1,053,600 for the improvement of a gravitation system which is supplying the city water. City Engineer Childs has submitted figures of the estimated cost The proposed plan is to duplicate the present pipe line from a point about two miles further up Elbow River than the intake of the present system, and run it into the city to join the city waterworks system at a point near the reservoir in southwest Calgary. Sedimentation tanks at the intake are provided in order to make the water as clear as possible, and a filter basin near the reservoir. The estimated cost of the new main is $738,600; the sedimentation tanks at the intake and the enlargement and lining of the reservoir, $15,000; and the installation of 12,000,000 gallon capacity filters, $200,000.

**South Vancouver, B.C.**—The Fire, Water and Light Committee has decided to ask quotations for 25 miles of 4-in. water piping and 10 miles of 6-in. water pipes, at an estimated cost of $70,000.

**Toronto, Ont.**—Assistant City Engineer George G. Powell has recommended the construction of 13 additional filters at the filtration plant, at an estimated cost of $735,000, along with a new pipe line to the tunnel, at a further cost of $140,000. The Board of Control has decided that plans and specifications should be prepared at once.

### POWER PLANT NEWS.

**Saltcoats, Sask.**—The municipal authorities of this town are about to issue debentures for the installation of electric light facilities. The estimated cost for the work is placed at $17,000.

**Beaverton, Ont.**—The municipal council have applied to the Hydro-Electric Commissioners for a specific volume of current. Beaverton is the first municipality in that district to make such an application.

**Guelph, Ont.**—The annual report of the Light and Heat Commission shows that this

department has produced a profit of nearly $23,000 for the year ending December 31st, 1911. The following shows the manner in which this amount is made up:—

| | |
|---|---|
| Total income | $110,188.35 |
| Total expenditure | 76,748.97 |
| Net gain | $ 33,439.38 |
| Debenture interest | 10,738.85 |
| Balance carried to credit of profit and loss account | $ 22,700.53 |

The income in the gas department was $55,495.34, and in the electric department $54,693.01. The total income was $110,188.35. Expenditures in the gas department were $37,603.59, of which salaries, $6,074, and labor (purification), $21,082.22, were the chief items. In the electric department's expenditure of $28,004.09, the cost of the Hydro-Electric power, $16,437.01, and $3,291.49 for general repairs were the chief items. There were $6,141.29 of general expenditures, and $5,000 depreciation, showing a grand total expenditure of $76,748.97. The balance sheet submitted by the auditors showed assets of $464,400.28, and total liabilities of $269,253.96, principally for debentures, due bank, city of Guelph and open accounts. The contingent fund for depreciation stands at $75,000, and there is a premium of $4,337.20, written up for reserve fund.

**Montreal, Que.**—The Montreal City Council are erecting a large central refrigeration plant at the Bonsecours market.

**Charlottetown, P.E.I.**—The Island Cold Storage Co. of P.E.I., are building a refrigeration plant at Charlottetown.

**Montreal, Que.**—The C.P.R. are installing a large refrigeration and ice-making plant at the Windsor Street Terminal, Montreal.

**Montreal, Que.**—Messrs. J. Robertson & Son, Montreal, are installing a cold storage plant upon the Carbonic Anhydride System. This is one of the very few plants of its kind in the Dominion.

**Montreal, Que.**—Messrs. Leonard Bros., fish merchants, Montreal, are extending their cold storage plant. The original plans and specifications for all the foregoing installations were prepared by Mr. Charles Bishop, Consulting Refrigeration Engineer, Montreal.

**Vancouver, B.C.**—P. Burns & Co., Ltd., are installing at their Edmonds Market a 1-ton Armstrong refrigerating machine.

**Edmonton, Alta.**—O'Donnell, Clark & Co., of Edmonton, Alta., have purchased from the Armstrong Machinery Co. a 5-ton Alaskan ammonia compressor, to be installed at once and operated on the brine system.

**Montreal, Que.**—A number of Montreal capitalists are interested in the formation of the Stadacona Hydraulic Company of Quebec, whose plant at Seven Falls, near St. Anne de Beaupre, will have an initial development of 10,000 horse-power. The entire output has been sold to the Quebec Railway, Light, Heat & Power Co., and to the Bayless Pulp & Paper Co. of Penn, who are establishing a large paper plant in the vicinity. There will shortly be a public issue of bonds.

## CATALOGUES.

**G. J. Worssan & Sons, of London, Eng.,** have sent us a catalogue of their "Zero" $CO^2$ freezing and cooling machines. The agency for these machines has been taken up by the Canada Caramel Co., 61 Dalhousie St., Montreal.

**The Hill Electric Switch Mfg. Co.,** 65 McGill St., Montreal, have commenced the publication of a series of bulletins dealing with the lines they manufacture. These bulletins are perforated for purposes of filing. Bulletin No. 1 is descriptive of panel boards, and gives prices and sizes of all types of such equipment. They have also issued a circular on the "Ever Ready" pocket meter for testing either current or voltage. This instrument is particularly inexpensive, yet simple and accurate of construction.

**Elbert Hubbard,** the sage of East Aurora, has compiled a list of the world's twenty greatest men, about which he has built an essay, and refers to Joseph Dixon as "a man whose work has profoundly influenced civilization, yet, strangely enough, a man of whom the world at large knows little." This tribute to the founder of the Dixon Company is well worth reading, especially by those who wish to learn more of him, or by those who admire Mr. Hubbard's vigorous pen. Owing to a limited edition of this booklet, copies cannot be distributed except by request. The Joseph Dixon Crucible Company, Jersey City, N.J., will be pleased to honor such requests.

**"Superheated Steam in Locomotive Service,"** by W. F. M. Goss, has just been issued as Bulletin No. 57 of the Engineering Experiment Station of the University of Illinois. It presents, in abridged form, the information which originally appeared as Bulletin 127 of the Carnegie Institution of Washington.


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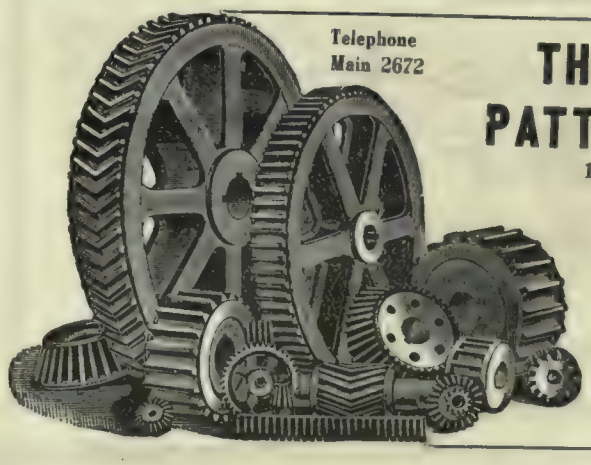
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The favorite brands with users of good steel.
A large assortment of sizes in stock.
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**Bulletin No. 24**, "The Economy Steam Turbine for Belt Drive," has just been published by the Kerr Turbine Co., Wellsville, N.Y. This bulletin shows belted economy turbine installations which are effecting marked economies over apparatus previously used.

**The Ogilvy Engineering Co.** have sent us a booklet on the Maxim Boiler. This gives diagrams and illustrations of the boiler, and deals with its most prominent features. Copies of this can be had by addressing Bank of Ottawa Bldg., Montreal.

**The International Machine Tool Co., Indianapolis, Ind.**, have issued a booklet with the title of "Libby lathe work," in which are shown the size, shape and form of a few of the many pieces of work now being satisfactorily and economically machined on the **Libby** lathe. The times given are the average time in which the work is being done every day in actual shop practice, and will doubtless prove of interest to shop superintendents and foremen.

**Marion & Marion**, patent attorneys, of Montreal and Washington, have sent us a copy of the "Inventor's Adviser and Manufacturer's Hand Book on Patents, Trade Marks and Designs." The book gives a complete description of the method of securing patents and of points to be considered when obtaining same. It is a valuable acquisition to the library of any inventor.

## BOOK REVIEWS.

The book **"Feed Water Filtration,"** published by James Beggs & Co., 36 Warren St., New York, has been in such demand that a fourth and revised edition has just been issued. This book deals with the removal of organic matter, oil, grease, and other floating particles from from boiler water, and illustrates and describes numerous installations of the Blackburn Smith Feed Water Filter and Grease Extractor. A free copy will be sent by James Beggs & Co. to anyone interested.

**"A New Analysis of the Cylinder Performance of Reciprocating Engines,"** by J. Paul Clayton, has just been issued as Bulletin No. 58 of the Engineering Experiment Station of the University of Illinois. For many years the only accurate method of ascertaining the steam consumption of an engine has been to measure or weigh in some manner the water used. It has been discovered, however, that the quality of the steam present in the cylinder at cut-off controls the form of the expansion curve of the indicator diagram in a perfectly definite way. From this fact there has been developed a method of computing the steam consumption of an engine from the indicator diagram alone to within 4 per cent. of the actual consumption as measured by test. There has also been developed a method of obtaining the volumetric clearance of a cylinder using steam, gas, air, or ammonia to a degree of accuracy almost as great as the method of filling the clearance space with a known weight of liquid. The bulletin contains an exposition of the methods employed in obtaining the steam consumption and clearance, and also methods of detecting leakage from the indicator diagram with the engine in regular operation. Copies of Bulletin No. 58 may be obtained upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

## THE RAILWAY EQUIPMENT CO., OF TORONTO, LTD.

A RECENT addition to the industrial organizations of the Queen City is that of the Railway Equipment Co., of Toronto, Ltd. While the name indicates in a general way the nature of the firm's business, it may be here stated on the authority of information received by

our representative, that the work undertaken will partake more specifically of the repair, rebuilding, exchange and supply of electric railway equipment, consisting of trolley cars complete, car bodies, trucks, motor apparatus, individual motors, armatures, armature cores, field coils, etc. A well equipped repair shop, located at 1240-1250 Dundas Street, Toronto, forms a feature of the company's plant, and realizing the importance of the armature department, the management have secured the services of a superintendent of large experience to take charge of same.

The officers of the company are: President, William Harper, Toronto; secretary, Geo. H. Crow, Reading, Pa.; and treasurer, C. L. Allan, New York City.

### TRADE NOTES.

**The Murphy Iron Works, Detroit, Mich.**, recently executed their fourth order for Murphy furnaces from The Laurentide Co., Ltd., Grand Mere, P.Q. This firm have had experience of the furnaces since 1905, and their installation now embraces 14 sets, of a total of 4,250 horse power.

**The Linde-Canadian Refrigeration Co.** recently opened a branch office in Winnipeg which will handle all business in Manitoba and West as far as Calgary, Alta. Mr. F. H. W. Guard has left the Montreal office to take charge of this territory, and Mr. R. P. Mason has been appointed refrigeration engineer to succeed Mr. Guard.

**Alberger Pump and Condenser Co.**—Announcement is made, dated as from June 1st, 1912, that the three associated concerns, the Alberger Condenser Co., Alberger Pump Co. and the Newburgh Ice Machine and Engine Co., will in future be known as the Alberger Pump and Condenser Co. The officers of the new company are George Q. Palmer, president; William S. Doran and D. H. Chester, vice-presidents; and William R. Billings, secretary-treasurer. The head offices are at 140 Cedar Street, New York. The large amount of condenser and centrifugal pump orders in hand has demanded important additions to the plant and equipment of the works at Newburgh, N.Y. The line of apparatus manufactured by the Alberger Pump and Condenser Co. consist of surface, jet and barometric condensers of various designs, cooling towers, a complete line of volute and turbine type centrifugal pumps, steam turbines, feed water heaters, hot water service heaters, and expansion joints.

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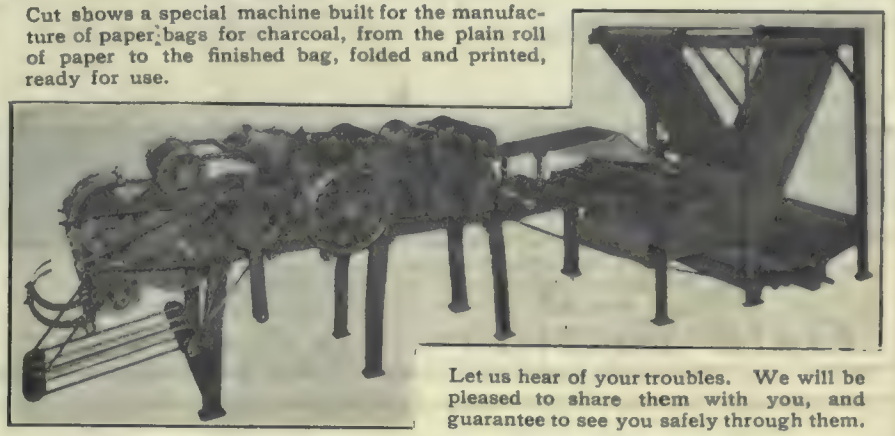

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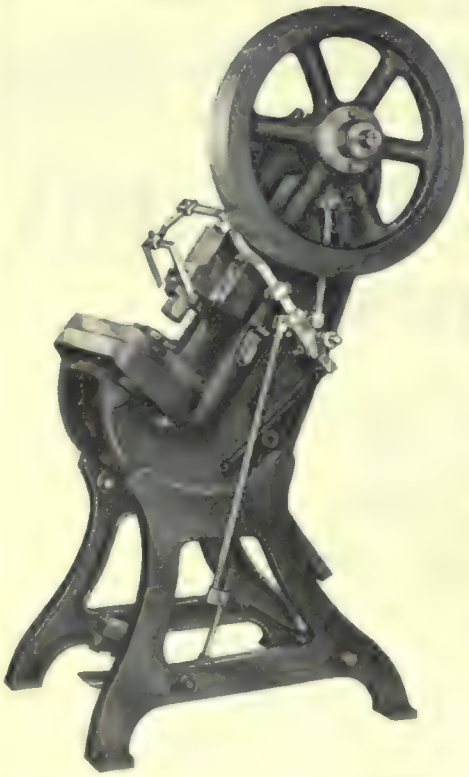

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# Some interesting features of the C.N.R. Shops, Winnipeg

By J. H. WILLIAMS

THE Canadian Northern Railway locomotive shops at Winnipeg are engaged exclusively on repair work and rebuilds, and turn out on an average from 35 to 40 engines per month. This includes heavy repairs, general repairs, wrecks and rebuilds. In addition, there are usually several steam shovels, pile drivers, etc., under repair month by month.

The erecting, boiler, tank and machine shops are all in one building, 650 feet long by 200 feet wide, divided into three bays, two of which are 75 feet and one 50 feet wide. The two outer bays are of the former width, while the 50 foot bay lies between them. The south bay (75 feet) forms the erecting shop and contains twenty-six transverse pits, pitched at 22 feet centres. One of these, near the centre of the shop, is the hoist pit, over which is located a 125-ton wheeling crane. The erecting shop is also served by three hand operated 2-ton travelers. Engines are brought to any desired pit by an 85 feet electrically operated transfer table, which also serves the car shop. They are brought in, pilot end first, so that the front end is towards the machine shop. This enables tubes to be handled by the 7½ ton traveler in the adjacent bay—a very convenient arrangement. The same traveler also assists in erecting front end work, the erecting shop pit tracks being extended 15 feet into the machine shop for this purpose.

Extending the full length of the shop is a large galvanized iron suction pipe, clearly seen in Figs. 1 and 2. This pipe is connected to an exhaust fan and has at each pit a vertical branch extending down between the crane runways of the erecting and machine shop bays. When ready for steaming, the engine stack is coupled up to this vertical branch by a short connecting length and the exhaust fan quickly draws up the fire, at the same time removing all smoke through the roof.

Every appliance is to be found here for expediting work and cutting down costs. Needless to say, an engine is never stripped for a cracked frame if thermit can be used. Figs. 3 and 4 show an exceptionally large thermit weld made in these shops. The weld was 25 inches in length, being something unusual in locomotive repair practice. It was made in the usual way, a matrix of wax being built up to the exact shape desired for the reinforcement. The weld, besides being 25 inches long, was 3 inches thick, necessitating the use of two crucibles, each holding 100 lbs. of thermit, 10 lbs of mild steel punchings and 2 lbs of manganese. Fig. 4 shows the ponring gate which was 32 inches long. Only one riser was necessary. Naturally, in welding so large a section, great care had to be taken when preheating to equalize the temperature and bring all parts of the section to a uniform red heat. Great precautions were also necessary in making allowance for expansion and contraction. However, all these obstacles were successfully overcome and the weld turned out perfect in every respect. We are indebted to the Goldschmidt Thermit Co., New York, for the use of the two cuts illustrating this weld.

### Machine Shop.

The centre (50 ft.) bay is devoted chiefly to the heavy machine tools and to wheel work. All machines in this bay have individual motor drives, power being purchased from the Winipeg Electric Railway Co. The equipment here includes a 90-inch vertical boring mill, 24-inch slotter, horizontal boring machine, 60-inch planer. Bertram coach wheel lathe, 36-inch slab miller, and a 42-inch heavy duty engine lathe. There are also five smaller heavy engine lathes, two Niles driving wheel lathes, a 300 ton hydraulic wheel press, etc., etc. All tire work is done in this bay. At present the tires are heated by gasoline in pipe rings; but crude oil furnaces having a capacity of six tires are about to be installed.

In fig. 6 is shown one of the interesting labor-saving devices developed in these shops. The illustration shows the

Fig. 1. Erecting shop looking west. Hoist pit in the foreground.

method used for placing wheels in the Bertram coach wheel lathe; without employing the overhead traveler. A plain bar is bent into a V-shaped yoke (A), its two arms being hinged to lugs on the lathe bed. At its outer end it is loosely attached to a simple crosshead (B) which is operated through a stout piston rod by an air cylinder below the floor. The device is here shown in its elevated position; when the air is exhausted the piston falls until the crosshead rests upon the floor. The wheels and axles enter the shop by a track parallel to the lathe and not seen in the illustration. When the wheels are opposite the lathe a pneumatic pit jack engages with the axle and raises the wheels from the track. They are then swung round parallel with the lathe and run across the floor until the axle is just beyond the crosshead (B), which of course is resting upon the floor. Air is now admitted to the cylinder and the yoke (A) raised, lifting the wheels from the floor. The axle is now rolled along the yoke and the wheels enter the lathe. Any endwise adjustment is easily made by means of the small rollers (C) which are attached to the yoke. To operate this device, two 8-inch Westinghouse air brake cylinders are used, one being bolted on top of the other to give sufficient length of stroke. As may be seen, the lathe was in use at the time this photograph was taken; so that it was not possible to show the segment of the large gear wheel removed and a pair of wheels about to enter. However, no difficulty will be found in grasping the idea from the above description.

Fig. 7 shows the 60-inch planer in this bay set up for planing shoes and wedges, one head planing the inside of the castings, while the other planes the outside of another set of castings. For planing the inside, the shoes or wedges, as the case may be, are placed in a long trough-section casting (D) which has a tongue fitting the slots of the planer table. Set screws through the side of this trough securely clamp the shoes, which then have the inside of both cheeks planed simultaneously by the tool (A), which is of the exact width required. For planing the outside, the work is set up on blocks as seen at (B) and bolted to the table in the usual way. The tool for this operation is seen at (C) and in greater detail in fig. 8. To relieve the tool on the reverse stroke of the planer, each arm has a knuckle joint swinging on a substantial pin, the construction being clearly seen in fig. 7. The two arms are not quite parallel, being set in about $\frac{3}{8}$ inch at the points. This makes the tool act in the same way as if the head of the planer were swung over, and thus does away with the drag of the tool

Fig. 3. Thermit weld. Crucibles and Mould Box in position.

Fig. 4. Thermit Weld, showing gate and reinforcement.

Fig. 2. Erecting shop, looking east.

on the back stroke. The output of shoes and wedges from this planer is about 26 per day.

**75 Ft. Bay, Brass Room, Etc.**

The brass room is located at the bottom of the 75 ft. bay of the machine shop and is divided off from the main shop by a wire screen. It is excellently lighted, and while not large, is well equipped for turning out work rapidly

Fig. 5. Heavy Tool Bay of Machine Shop, looking east.

and economically. The brass-working machinery is all of modern design and includes, among other items, six lathes (turret and plain), 25-inch drill press, buffing wheels, tool grinder, etc., etc. The rest of the 75 ft. bay is taken up by bench and machine work. One part is used exclusively for manufacturing purposes (shop order work). The machines in this department include a 42-inch Niles boring mill, 42-inch Bertram ditto 24-inch Bertram ditto, triple head bolt cutter, four iron working turret lathes, and a Bertram 4-spindle drill, chiefly used on arch bars, draw bar pockets and other car work.

The motion gang is an entirely self-contained department having all the necessary equipment for carrying out this class of work. Nearby it is a gang handling all air brake, injector and lubricator work, while in the centre of the bay there is a group of machines for general purposes. The driving box and rod gangs are provided with a hydraulic press, 24-inch and 40-inch boring mills, 18-inch and 24-inch lathes, 18-inch double head shaper, 36-inch planer, 18-inch slotter, heavy duty drill, etc. The machines are arranged in such order as to reduce handling to a minimum, the work passing straight along from one machine to the next and being finished on the last. Engine trucks are repaired on two elevated tracks standing about 2 feet above floor level. This enables men to get below the trucks and generally makes for convenience in handling. The trucks are placed on the elevated tracks by one of the two 1½ ton electric travelers which serve the whole length of this bay. All the more important machines are fitted with handy jib cranes made on the premises from 6-inch channels and 4-inch pipe. In this way a great deal of lost time due to waiting for the overhead traveler is eliminated.

**The Tool Room.**

The tool room is located in an annex about half way down the north bay of the machine shop, and is a thoroughly well equipped department. The machines, walls, shelves, racks, etc., are painted white in order to obtain the maximum value of the natural lighting, which is provided by windows on two sides of the room. Fig. 9 gives a good idea of the bright appearance of the shop. It is the intention, in the near future, to build an addition to the tool room and instal a forge and hardening furnaces. At present, lathe and planer tools, etc., are forged in the blacksmiths' shop, whence they are taken to the tool room to be rough ground dry to standard shapes. This is done on the Sellers No. 1 tool grinder seen in the foreground to the right of Fig. 9. The tools are then returned to the smith to be hardened, after which they are again sent to the Sellers grinder, where they are wet ground to finished shape and afterwards delivered to the tool store. This process is considered to be more economical than hardening the tools immediately after forging, as the smith does not have to forge so accurately to size and the tools are more quickly ground. All lathe, planer, shaper and slotter tools are of high speed steel.

For sizes below ½ inch and above 1½ inch, carbon steel twist drills are used, while drills between these two sizes are of high speed steel. They are ground on a Yankee drill grinder, one man having sole charge of this work. He also grinds all chisels, flat drills, etc., and keeps in order the emery wheels throughout the machine shop, visiting each grinder twice a day. A second Yankee drill grinder has been fitted up with a special spindle and is used for general grinding. There is also a No. 2 Brown & Sharpe universal grinder on which saws are sharpened, some of them as large as 30 inches diameter. The large sizes are, of course, ground in a horiz-

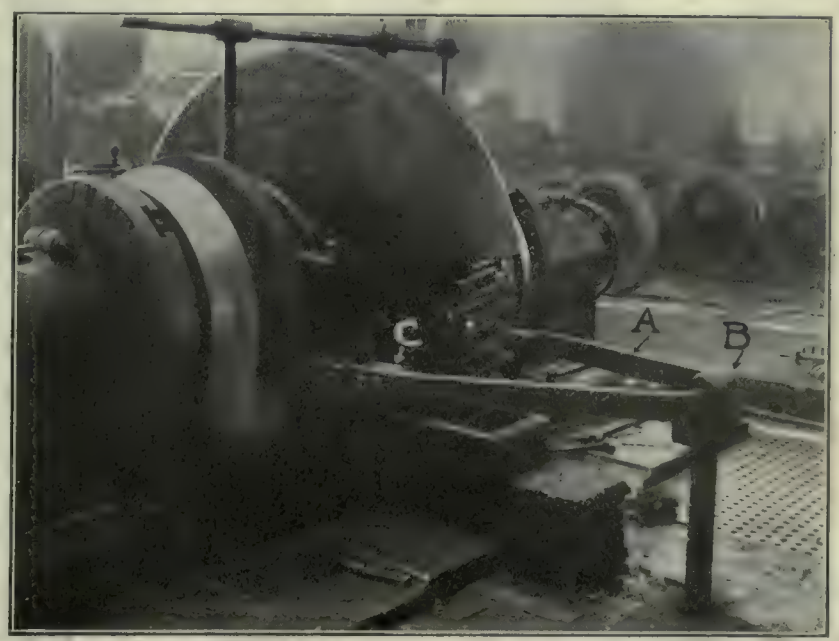



Fig. 6. Method of running truck wheels into Bertram Coach Wheel Lathe, without using overhead travelling crane.

ontal position. This B & S grinder is used on all reamers, rose bits, end mills, etc., and is fitted with an internal grinding attachment.

Further equipment includes one 12-inch and one 16-inch Pratt & Whitney tool room lathe with taper turning and

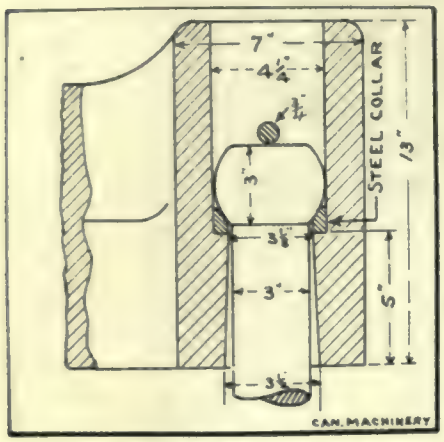



Fig. 12. Attachment of Piston Rod to Flanging Clamp.

relieving attachments; Canada Machinery Corporation 18-inch by 6 feet engine lathe; 16-inch Flather shaper; Q & C power hack saw; 20-inch Davis drill press; and two No. 3 milling machines. Of these two millers, one is a Brown & Sharpe, and the other an R. K. Le Blond.

### Milling Beading Tools.

The Le Blond miller is seen in Fig. 10, set up for milling flue beading tools in batches of a dozen at a time. In some shops these tools are milled one at a time, being gripped in a machine vise for the purpose, but in the Canadian Northern shops, a much more expeditious method has been devised and is here illustrated. The beading tools are first rough forged to gauge, as shown at (A), and are then set up, twelve at a time, in the fixture seen on the milling machine table. The bar (B) serves as a gauge against which the face of each tool is set before being finally secured by the set screws in the clamping bar. By removing the set screw (C), the gauge bar (B) may be swung down out of the way. The table is then raised and the tools are milled by the gang cutters shown. A finished tool is shown at (D).

Fig. 11. Air-operated Flanging Clamp in Boiler Shop.

The machines in the tool room are all operated from line shafting, the latter being driven by a 15 H.P. motor. One corner of the room is given up to belt and hose repairs, while in another are the lockers for the men's clothes, etc.

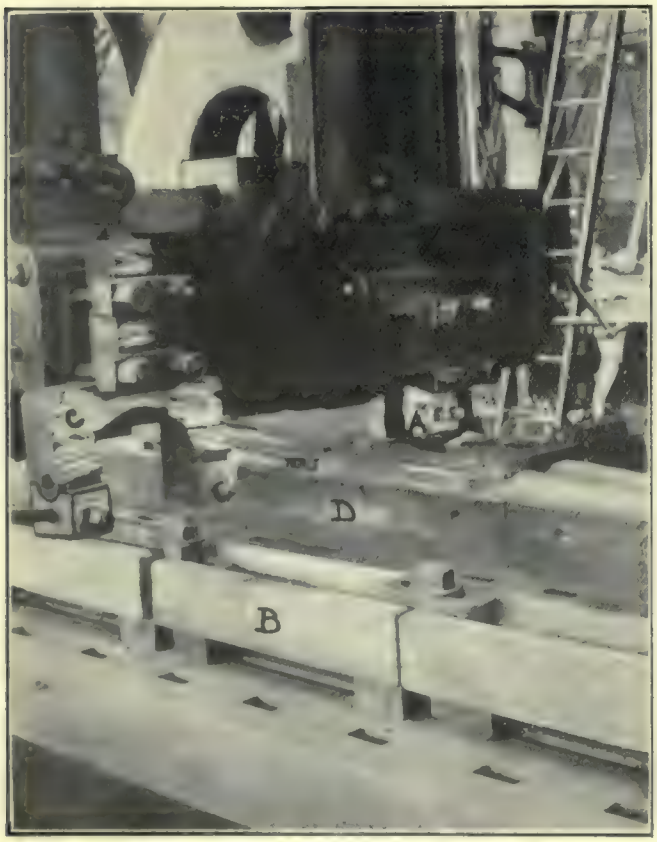



Fig. 7. Planing Driving Box Shoes in batches. One head planes the outside and the other the inside.

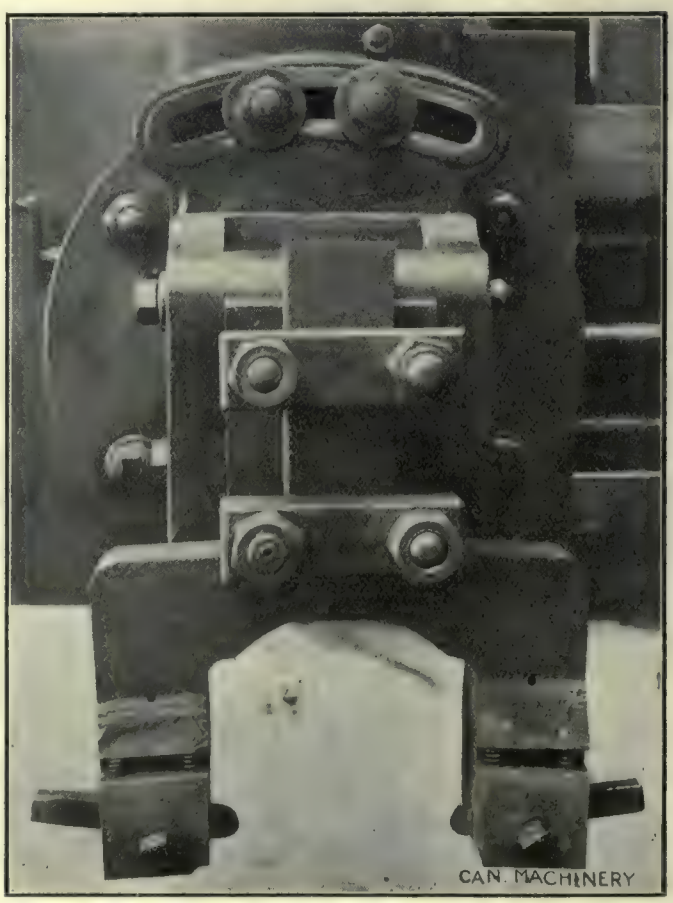



Fig. 8. Detail of planer tool for outside of shoes and wedges.

A third corner—that seen in Fig. 9 – is used for the repair of pneumatic tools used in the erecting shop, boiler shop, car department and roundhouse. One man devotes his entire time to this work. The air motors are all numbered and are brought to the tool room in rotation, two from each shop daily. They are examined, oiled, and, if necessary, repaired. In this way, all motors are kept in good shape, enabling them to work at their maximum efficiency.

Dies for bolt cutters and pipe threading machines are all made from high speed steel. They are threaded by a hob in the machine in which they will eventually be used, thus ensuring absolute accuracy. When hardened and finished they are fyled away in very convenient racks, which enable the dies for any given machine to be immediately identified. A large number of special tools, jigs and fixtures have been devised in this tool room, but considerations of space forbid their description. Outside the tool room is the tool store where all tools are given out on check.

### Boiler and Tank Department.

The east end of the two bays of the machine shop is given over to boiler and tank work, the equipment including large Bertram double punch and shear; single ended punch for tank work; large crude oil flanging furnace, Bertram horizontal punch; Lennox rotary bevel shear; small hand clamps for ashpan work; pneumatic flanging clamp, etc., etc. All the machines are fitted with individual jib cranes and air hoists, as is also the flanging furnace.

All plate work is flanged by hand, the shops not being equipped with a hydrau-

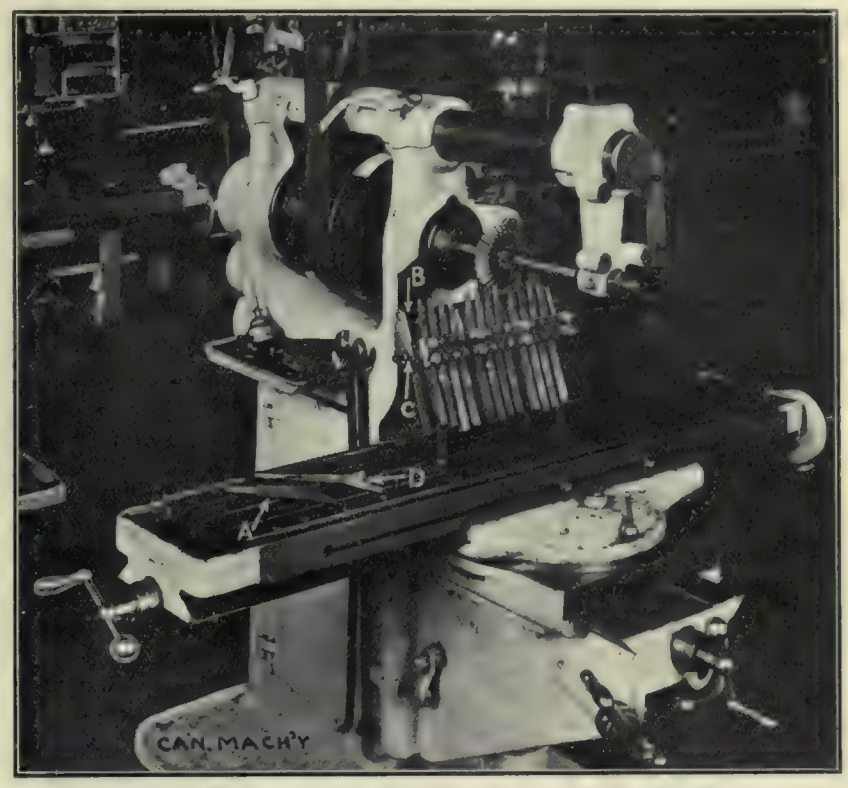



Fig. 10. Milling flue beading tools in lots of twelve at one setting.

FIG. 9. GENERAL VIEW OF INTERIOR OF TOOL ROOM.

lic flanging press. The clamp shown in fig. 11 is used for holding plates during flanging, and is another of the many ingenious home-made devices got out in these shops. It is operated by air, there being two 20-inch cylinders below the

Fig. 13. Bulldozer set up for making Drawbar Pockets.

floor, bolted to the lower jaw of the clamp, one at each end. The piston rods are 3 inches in diameter, balled out at the top to a diameter of 4¼ inches. The holes in the jaws of the clamp are 3½ inches, those in the top jaw being counterbored to suit the balled heads of the piston rods. A ¾ in. pin serves to raise the clamp. Fig. 12 shows the arrangement, and from this it will be seen that the top jaw is free to adjust itself evenly upon the work. The clamp is used as follows in the case of a front flue sheet. The flanging block is balanced on the lower jaw and the heated plate placed upon it. Air is then admitted to the top side of the two pistons by means of a three-way valve operated by the handle seen on the right. The flue sheet is thus held securely to the block during the process of hand flanging. The clamp is also used for pressing out cylinder head casings, piston valve chamber casings and air reservoir heads; in fact it has almost as many uses as a hydraulic flanging press. The shop air system carries a pressure of 110 lbs. per sq.. inch, which enables the clamp to exert a pressure of about 34 short tons.

The boiler and tank departments, being situated at the extreme end of the shop, have a separate tool store of their tapped off the supply line and enters below the piston, which is packed with a cup leather. The piston rod is thus pushed outwards from the top end of the cylinder, the thrust being taken in the usual way by a plank or an "old man."

### Heating and Lighting.

The main shop and tool room are heated in winter by direct radiation from live steam pipe coils attached to the walls between the doors and windows. This system is probably the best in a plant such as this, where the erecting shop is served by a transfer pit. The frequent opening of the side doors allows large quantities of heat to escape, and the live steam coils warm up the shop again more rapidly than does the indirect system of radiation in which heated air is distributed by fans. At all events, such is found to be the case here. The round house in connection with this plant is heated by the indirect system and it is found almost impossible to keep up a comfortable temperature in severe winter weather.

General artificial illumination is by Cooper-Hewitt mercury vapour lamps, in addition to which connections are provided for incandescent lights and extension cables to each machine and also for the erecting shop pits.

own, where tools, oil, waste, etc., are given out. Air motors for drilling staybolt holes, tell-tale holes, etc., are fitted with a pneumatic feed consisting of a small piston and cylinder screwed in instead of the usual feed screw. Air is

### The Blacksmith Shop.

The blacksmith shop is adjacent to the west end of the machine shop, being divided therefrom by a brick wall. Material is handled between the stockyard, blacksmith shop, machine shop and stores by a complete system of industrial tracks, which extend also to the car shops, since the smithy serves both departments. There are twenty-five fires, all provided with hoods, leading to a large overhead flue from which the gases are drawn by an exhaust fan. The three steam hammers, of 2,000 lbs., 1,500 lbs. and 1,000 lbs. capacity respectively, are conveniently placed for the various classes of work, and are grouped around a central jib crane which serves them all. In addition to these, there is a Beaudry trip hammer, with oil furnace, for all light work.

The principal heavy equipment consists of one heavy punch and shear, one 1½ inch Acme bolt forging machine, one 3-inch Acme forging machine, Bertram bulldozer and a Newton cold cut-off saw. The machines are all served by crude oil furnaces. The forging machines are so placed that work passes direct from them to two triple-headed bolt cutters, and thence, by small cars on the industrial tracks, to the stores.

### Spring Department.

One corner of the shop is set aside for spring work. This department is equipped with an Evans' spring punch and shear; a pneumatic roller for giving camber to the plates; a nibbler; screw clamp for use while putting on bands; tempering furnace and quenching tank. Much time is saved in spring tempering by heating the plates only once. They are brought to a hardening heat and then cooled off (not quenched) in oil, until their temperature is reduced to the flashing temperature of the oil. From this point they are allowed to cool off in the air; so that hardening and temper-

Fig. 14. Making Drawbar Pockets. The heated bar in position for first operation.

ing may be said to be accomplished at one heat.

### Making Draw-bar Pockets.

One of the interesting jobs done in this shop is the making of draw-bar pockets complete at one heat on the Bertram bulldozer. This is done in two operations, the first one forming the pocket, while the second turns in the lips and cuts them off to length. Fig. 13 shows the dies set up for the job. There are two sets of dies and rollers, the upper (A), performing the first operation; while the lower (B), performs the second. As may be seen in fig, 14, the heated bar (D) is first placed across the upper dies; the head of the machine then advances and the rollers (A), fig. 13, together with the casting which carries them, force the bar round the die (C). The distance between the rollers of course corresponds to the outside width of the pocket, while the die (C) is the same width as the inside of the pocket. The operation of forming the lips has now to be performed. The pocket is lifted from the upper dies and turned end for end, so that its open end faces the moving head of the bulldozer. It is then placed in the lower dies, which, as the head advances, form the lips, while at the same time two shear blades trim them off to length. The way in which this is done will best be understood from a study of fig. 16, the reference letters corresponding with those on fig. 13. The finished draw-bar pocket is shown at (E), fig. 15. In some shops it is necessary to take two heats for this job, or else set up the dies for the two operations on two adjacent bulldozers. It will thus be seen that the method here described effects a considerable saving of time and money.

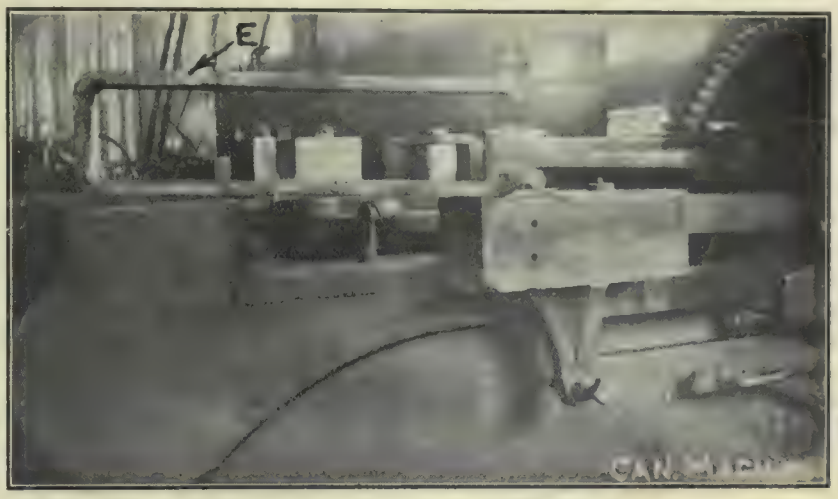



Fig. 15. The finished Drawbar Pocket—seen at (E).

### The Grey Iron Foundry.

The foundry is a brick building of three bays, and is 150 feet long by 90 feet wide. The natural lighting is exceptionally good, but otherwise there are no special features to be noted. As is usual the centre bay forms the main molding floor, being served by a 10-ton electric traveling crane. Of the two side bays one is used for the smaller molds, while the other is occupied by the core-making department. There are two core ovens, one being used for small cores, and the other for larger cores and dry sand molds. The foundry is equipped with three Pridmore molding machines, used chiefly on grate bars, stake pockets, queen posts and general car work. No brass castings are made, the company purchasing all such from outside firms.

There are two Whiting cupolas, of 46 inches and 62 inches diameter respectively. Blast at 11 oz. pressure is supplied by a No. 8 Sturtevant fan, belt driven by a 30 h.p. motor. Pig, scrap and coke are raised to the charging platform by a hydraulic hoist. About 16 molders are employed and a cast takes place every day, the average output be-

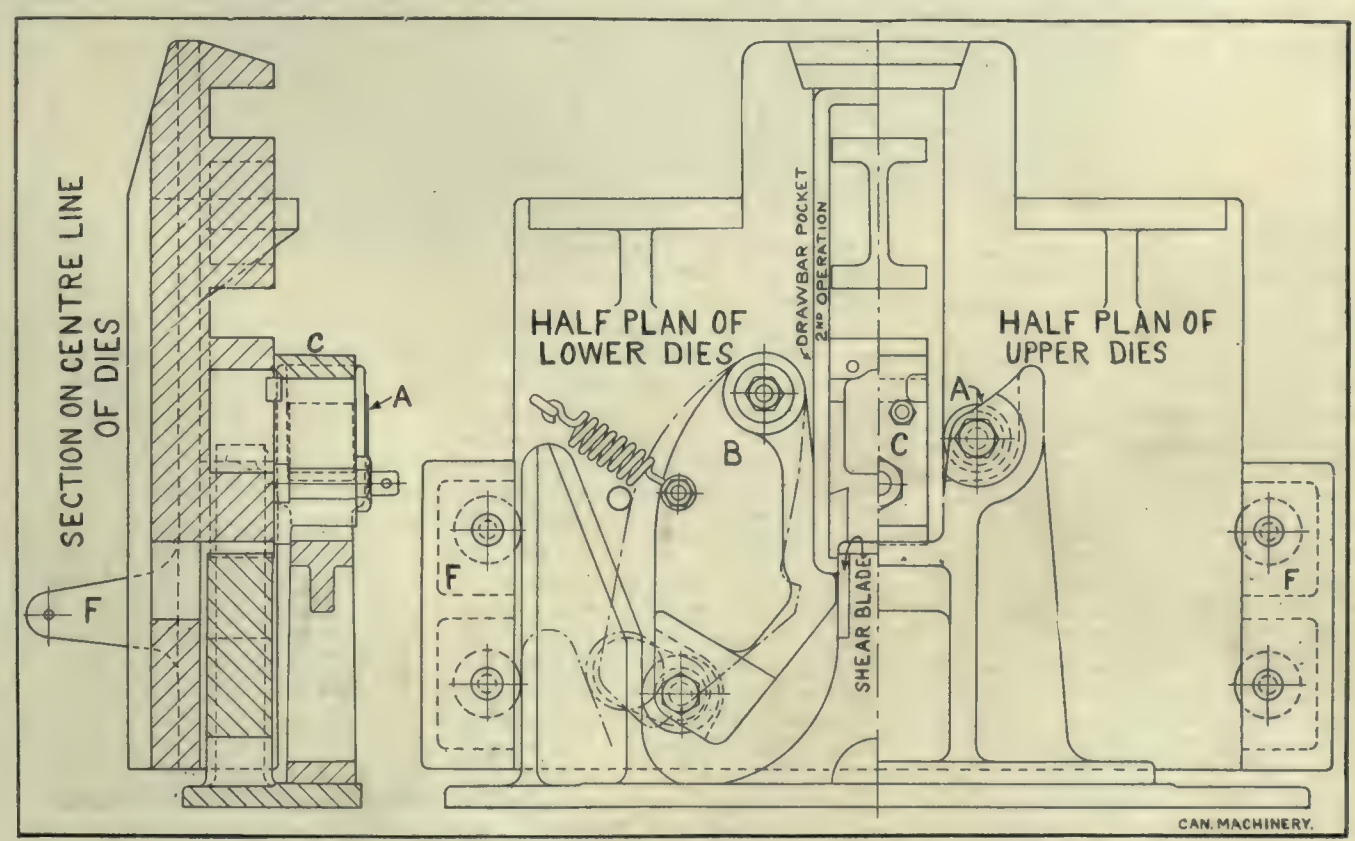



FIG. 16. — DETAIL OF BULLDOZER DIES FOR MAKING DRAWBAR POCKETS.

ing about 175 tons a month. The cleaning room contains two tumbling mills and the usual outfit of grinding wheels, etc. Pneumatic chipping hammers are used exclusively, the foundry being piped for compressed air.

### General Remarks.

The car shops carry out repairs only. Extensive alterations and additions are about to be made to them, so that we reserve their description to a future occasion.

We are indebted to A. H. Eager, superintendent of shops, for facilities granted us in securing photographs; and to D. M. Galloway, general foreman, and A. Hopkirk, shop engineer, for particulars of the various jigs and devices described in our article. We hope to illustrate more of these at an early date.

## MOTOR TRUCK WITH HYDRAULIC TRANSMISSION.

A MOTOR wagon weighing five tons, fitted with a system of variable hydraulic transmission, having as its basis a pump invented by Dr. Hele-Shaw, was the subject of a recent demonstration by Messrs. Campayne, Limited, 64 Victoria street, S.W., London, England. In this vehicle, the petrol engine is coupled direct to the pump, and the two motors, which are incorporated with the driving wheels, are actuated by oil which is forced through them and returns to the pump in a closed circuit. The pipes which convey the oil converge on a universal joint about the middle of the chassis and serve as radius and torque rods, and there is no flywheel, clutch, change-speed gear, or differential.

### Operating Features.

Alterations in speed are effected by altering the stroke of the pump, which is of the rotary plunger type. It consists of a cylinder body, with seven pistons, rotating on a fixed spindle in which are cut the induction and eduction ports. The pistons carry gudgeon pins having slippers which work in an annular groove on the inside of a revolving drum. The gudgeon pin centres are thus constrained to follow a circular path, and if this path is so set that its centre coincides with the centre of the fixed spindle no radial motion is communicated to the pistons; but if the centre is moved to one side or the other, liquid is pumped in and out, the rate of delivery varying with the amount of eccentricity and the direction according as the path is moved to the right or the left. The revolving drum or floating guide ring, can be adjusted to any desired position, but rotates freely on ball or roller bearings which are carried on guide blocks sliding in grooves in the main casing of the pump and connected to the stroke-varying spindle.

When the cylinder body is revolved, the floating ring revolves with it, the resistance of the slippers being greater than that of the bearings. In the central position, the slippers make no movement in their grooves, and in any other position, move too and fro only to an extent directly proportional to the stroke. A great saving of power is effected in this way, and the fact that the drum revolves confers another advantage. If the slippers moved around a groove in a fixed case, that case would have to be retained full or partly full of oil for the sake of the lubrication, and the churning up of the oil would mean waste of power; but because it rotates with the cylinder body and slippers, it can be kept full of oil by centrifugal force and yet no churning occurs.

### Motor Features.

The motors also present several novel features, one of these being the use of a cam which forms a track for rollers on the piston crosshead. This cam enables a large lap to be used in the valve action and reduces to a minimum the loss by slip or leakage in passing from the suction to the pressure side; it further enables the motor to work under its full load and at high speed without injurious vibration and without causing serious fluctuations on the pressure gauge, even at pressures up to 1,500 or 2,000 lbs. per square inch. In dynamometer tests, this motor has shown an efficiency exceeding 95 per cent., while in the motor truck, which is the first of its kind to be constructed and is therefore largely experimental, the overall transmission efficiency at the road wheels exceeds over 76 per cent. at eight miles an hour and 72 per cent. at 12 miles an hour, its maximum legal speed. Running at this latter speed on the level, the engine makes about 600 r.p.m., and the oil pressure is about 200 lbs. per square inch. Any lower speed can be obtained simply by reducing the stroke of the pump, and the same action serves to brake the vehicle on a decline; rapid acceleration and retardation being effected with remarkable smoothness and absence of shock.

In order to maintain speed on ascending a steep hill, the engine is accelerated and the pressure may rise to 1,200 or 1,500 lbs. per square inch; 2,000 lbs. being the limit for which the apparatus is designed. Many other applications of this system of hydraulic transmission can be suggested, such as lifts and hoists, cranes and sheer-legs, machine tools, hydraulic presses, etc.

## ALTERNATING CURRENT RAILLESS TROLLEY.

ACCORDING to the Electrical Review, the first alternating current railless trolley in the world is being shown in working order on a tar macadam road, by the Gesellschaft fur Gleislose Bahen Max Schliemann and Co., at the Electrical Exhibition of Leipzig. This is an electric omnibus traveling on a strip of tar macadam 100 feet in length, which has been rolled on an existing uneven stone pavement 6 cm. in thickness, after scratching out the joints as far down as possible. The omnibus is operated by a 1000-volt single-phase commutator motor of 15 horse-power output, 1,200 revolutions per minute, 50 cycles, which is started and controlled by shifting the brushes.

The motor drives the rear axle through a double cardan shaft and a worm gear of 10 to 1, and the rear wheels by an elastic clutch. The form of current, the voltage, and the use of a repulsion motor constitute decided novelties in this connection. The rubber tires are guaranteed for 20,000 kiloms., but 40,000 kiloms. have been reached in actual operation, corresponding to a cost of 1 cent per kilom. The vehicle is lighted by metal filament lamps. The speed is 20 kiloms. per hour, the average consumption being ½ kilowatt-hour per kilom.

## NEW SHUNTING LOCOMOTIVE.

A NEW shunting locomotive, recently built for the New York, New Haven and Hartford Railway, differs from those of earlier design. The difference lies in the fact that the locomotive has but one operating and controlling equipment, which is mounted in the centre of the cab. Thus, the driver always stands in the centre of the cab when running in either direction. The master controller is suspended from the roof. The locomotive was equipped in this manner in order to determine which was the better arrangement for shunting service, a double-end control—duplicate operating and controlling equipments at each end of the cab, or a centre-cab control.

**Canadian Imports.**—The imports of iron and steel from the United States for the fiscal year ended March 31st, 1912, totalled $36,382,725, as against $29,307,039 for the previous year. This total doesn't include machinery, agricultural implements, nor many other articles properly classified as iron and steel. The gain in imports from the United States during the last fiscal year in the above items of iron and steel was $7,075,686, or more than 27 per cent.

# The Motor Truck's Relation to the Foundry Industry*

By C. R. Hoyme

*The author of this paper treats his subject in an analytical manner, which is at once interesting and instructive. Without claiming that the motor truck is an all-sufficient remedy for transportation troubles of the factory, he points out where it may be advantageously employed, and quotes figures showing the approximate cost of operation, etc.*

THE transportation problem of the commercial world to-day has reached a critical point. Cities are growing and increasing in population, homes are being built in the suburbs and factory sites are becoming scarce in the cities, making it necessary to take ground in outlying sections, where railroad facilities are usually non-existent. What is the answer? "Motor transportation." "That sounds well," says the business man, "but is it practical, economical and can it be relied upon?" This depends largely on the kind and quantity of business and the relation of the markets to the source of production. The value of the motor truck lies in the fact that it extends the radius of action, decreasing the time of delivery from one-half to one-third of that of the old style horse method and under absolute control of the purchaser. From the standpoint of economy it has proved to have doubled the volume of merchandise handled and to have halved the cost, displacing from two to three double teams, thus saving the wages of two drivers.

**Proved General Business Utility.**

For the purpose of illustration let us take the Baldwin Locomotive Works. They are to-day using four Saurer 5-ton trucks, displacing twenty-four horses and twelve wagons, at an approximate saving of 33 1-3% per year. The Commercial Car Journal, a well-known publication, recently made a canvass of motor truck users, and asked an opinion as to whether their experience with the commercial car in every day use was such as to lead them to regard it as in an experimental stage, or whether it had passed this period and was a successful, practical and economical machine. Eighty-one per cent. replied in the affirmative, which proves conclusively that the motor truck has come to stay.

**Utility in the Foundry Trade.**

I have shown that it meets the requirements of general business, but, may it be successfully adapted to the use of the foundry trade? Before this question can be answered, there are a number of conditions to be investigated. We must first determine the length of the hauls; second, the general condition of your transportation department; third, the amount of material handled; and fourth. your present cost of transportation. We can then decide whether motor trucks can be utilized in your particular business to an advantage.

The Midvale Steel Company, started the ball rolling by placing one 3-ton truck in the delivery department, under whose jurisdiction came the transportation of the car wheels, tool steel, billets and general castings to their down-town customers. This was previously done by hired teams, and the truck is, to-day, advantageously doing the largest part of their hauling.

The Tiega Steel Company are also using a truck of 5-ton capacity, which is operated at a much lower cost than by the old style method; besides it makes from two to three trips a day more than could ordinarily be done by the work of four horses, which proves again that the motor truck is essential to the proper, economical transportation of foundry product.

**Short Haul Feature.**

Motor trucks, as to-day manufactured, are required to stand the excessive strains of heavy hauling, therefore, the materials used in their make-up, especially those of the heavier type, should be the best obtainable. The necessity of having ample power to haul the load at the rated capacity of the particular truck has also been worked out from a practical and common-sense standpoint.

Clinton 5-ton truck carrying a 6-ton load of large cast iron pipe.

The usé of a too powerful motor in a light truck would be ultimately disastrous, for the simple reason that it would not take long for the motor and the truck proper to shake themselves to pieces.

Motor trucks are manufactured of capacities ranging from one thousand pounds to 10 tons, of both electric and gasoline power, and just here, let us say that the electric type can be utilized to an advantage in a great many instances over the gasoline type. Take for instance, the foundry hauling about 3 miles from its plant, with numerous stops. Here, an electric truck will be the more economical, as the distance covered is not particularly great and the

*Abstract of paper read recently before the Philadelphia Foundrymen's Association.

many stops naturally require time for starting and the extravagant use of fuel in the gasoline truck. This example does not necessarily indicate that electric trucks can only be used for a three-mile trip. It goes to show, however, that for some kinds of service, the electric is the logical choice.

The electric is the right selection for some branches of city service by reason of the fact that the roads to be travelled over are usually passable. The better the roads, the better the performance of the car, for it must be born in mind that the electric is, in a sense, limited. Hard roads pull down the batteries, but do not have the same effect on gasoline cars, where sufficient fuel can be carried for a long run.

### The Gasoline Truck.

We have considered the transportation problem from the short haul standpoint, and in taking up the question of utilization of the gasoline truck, I should say that where you have a long freight haul and where the roads are hilly, muddy and sandy, the gasoline truck is that to be selected. Before a business man buys a truck, he should first secure figures showing the average cost of hauling his material or finished product per year, then by careful investigation, determine whether his particular work calls for an electric or gasoline truck, comparing the cost of up-keep of the two latter models of transportation to that of the existing cost, and taking in consideration the increased service and the possibilities of new business. I have seen instances where business houses have installed a motor truck of 5-ton capacity where requirements call for 3 tons. This is a big mistake and a matter that the purchaser should consider seriously. The right truck in the right place, operated with a degree of care cannot fail to be economical.

### Constructional Features.

The construction of a good motor truck should involve the following:—A four cylinder motor with ample power to pull the load at a speed of from ten to fifteen miles per hour over all kinds of roads; good substantial transmission with gears heavy enough to stand the strain and shocks of the average cobble stone street and rutty roads; a clutch

Spring Suspension—Clinton Truck.

that can be engaged freely and gently so as not to strain the motor or transmission; the right kind of jack shaft, preferably of the full floating type; substantial frame, with enough resiliency to give yield with the condition of the road bed; large tires; heavy springs, yet resilient enough to carry the load as easily as possible; wheels, necessarily of heavy construction, and the axles both front and rear of solid composition to withstand road shocks. Motor trucks of to-day have followed this general method of construction. Each year, they will naturally improve, not only in design, but in materials to take the place of that which is now employed.

The tire problem seems to be the bugaboo in economical up-keep, but there is no doubt that this will be overcome in a few years. We cannot class the motor truck as an absolutely perfect device, although its manufacture has been carried on for seventeen years abroad and about ten to fifteen years in America; yet, each and every day, something new develops to increase the efficiency of this labor-saving machine.

### Cost of Up-keep.

Nothing has been said as to the general cost of up-keep of motor trucks, and it might be well to dwell upon this point to show, or to outline, the general estimated cost of operating a 3 or 5-ton truck for a period of one year on a basis of fifty miles per day. First, we must consider the initial investment. Suppose a three-ton truck for the chassis cost $3,500.00, and the body $250.00, the complete investment would be $3,750.00.

| | |
|---|---|
| Interest on investment at 6 per cent. per annum | $225.00 |
| Depreciation of body at 20 per cent. per year | 50.00 |
| Storage, including washing, polishing and inspection | 300.00 |
| Driver's wages at $15.00 a week | 780.00 |
| Insurance, fire, $99.00, liability, $80.00, property, $32.00, collision, $108.00, total | 319.00 |
| Depreciation of truck at 10 per cent. per year | 375.00 |
| Annual expenditure for overhauling | 200.00 |
| Total fixed charges per year | $2,249.00 |
| Total fixed charges per day | 7.50 |

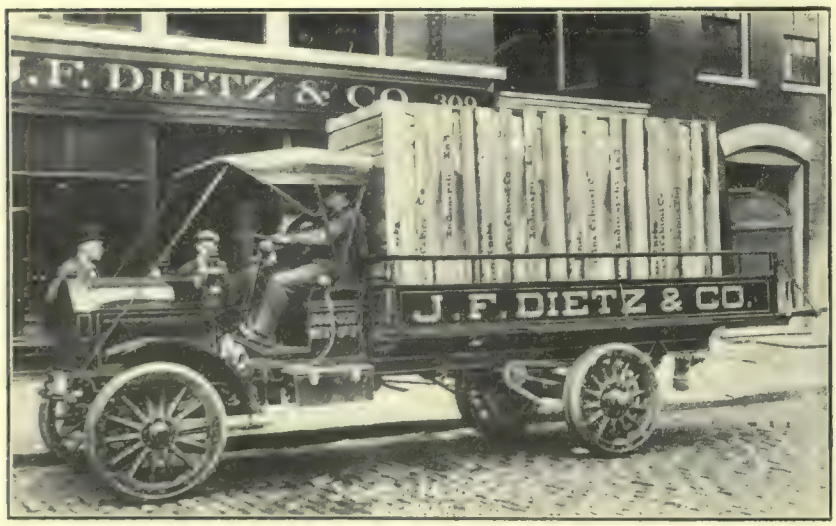
### Operating Costs.

The operating charges would be as follows:

| | |
|---|---|
| Gasoline at 8¼c* per gallon, operating seven miles to the gallon | .0121 |
| Oil at 30c per gallon, operating 200 miles to the gallon | .0015 |
| Tires at approximately $470 a set, 8,000 miles guaranteed | .0587 |
| Total cost per mile | .0723 |

This, on a basis of 50 miles per day would be $3.615. While these figures are approximate, they give an idea of what it costs to operate a truck of that capacity.

Trucks for economical employment in the foundry would be those of capacity from one to five tons, the cost of operating being proportionate to the capacity and investment. The average cost of a one-ton truck is $2,150; two-ton, $3,000; three-ton, $3,500; four-ton, $4,000; five-ton, $5,000. Tire companies guarantee tires on the larger trucks from 8,000 to 10,000 miles, depending largely upon the route covered, loads carried etc.




Schact 2-ton Truck, loaded with Hardware in Packing Cases. The Schact Motor Car Co. of Canada, Ltd., Hamilton, Ont.

*It is now more than double this price.—Editor.

### The Truck Operator.

The question of the operator should be very seriously considered, as the general cost of up-keep, length of service, depreciation and tire expense largely depend upon him. Experience has shown that it is a great deal cheaper to put on a man of some mechanical ability and to pay him about from $15.00 to $18.00 a week, than to get a cheap man for $9.00 a week who knows absolutely nothing about machinery. The latter man will be a ceaseless worry to the owner, oftentimes operating the truck without the proper lubrication, careful general supervision and inspection that a piece of machinery doing this kind of work must have. Would the business man ordinarily put a $5,000 investment in the hands of a $9.00 man to handle for him? When you stop to look at it from this viewpoint, it only goes to show that high wages spell economy in the end. The motor truck must have a certain amount of attention. It requires rest like a human being, and the truck that is operated day in and day out without attention will soon end up in the junk heap.

### Truck Body Construction.

Another important matter in connection with the adoption of the motor truck to the necessities of the foundry is the construction of the body. Experience shows that a substantial platform lined with sheet steel, built as close to the ground as possible, has proven to be the most satisfactory. There is a tendency when loading the truck with heavy castings, to block them; and nailing them to the body floor soon cracks it and puts it out of commission. By the use of the steel covering, loading is much more quickly accomplished, and it is very much easier to move a heavy casting over a smooth surface.

One of the most useful accessories that can be applied to commercial cars for such work as loading of heavy machinery and castings, is the power winch. The cost of a power winch is considered a little high, but the disregard of power winch efficiency from the standpoint of increased cost of the equipment alone is very short sighted. The power winch can be used in any sort of service where loads are bulky and heavy, the shifting of which would consume time and mean strenuous human effort. The winch can be operated by turning a crank, or direct from the motor, for both hoisting and lowering.

### The Schact Truck.

Numbers of Canadian concerns are now turning out high grade motor trucks suitable for every class of transportation. Prominent amongst these is the Schact Motor Car Co., of Canada, Ltd., who have a well-equipped factory at Hamilton, Ont. The "Schact" trucks have been designed for heavy duty service, and being considerably under-rated in capacity they will readily take 25 per cent. overload without any appreciable strain on the motor or working parts. These trucks are built in sizes of 1-ton, 2-ton, 3-ton, 4-ton, and 6-ton nominal capacity. The four cylinders are cast en bloc, the valves being on the right-hand side and completely enclosed. "Mea" magneto ignition and "Stromberg" carburettor are fitted; consequently engine and ignition troubles have been successfully eliminated. Unless otherwise specified, a left hand drive is fitted, and, in addition, these trucks are now being built with centre control, a feature which the Schact Motor Car Co., were among the first to adopt. The Hamilton plant, which has now been in operation about a year, has met with encouraging success. Mr. F. L. Reid was recently appointed general manager; he having previously held a similar position for two years with the parent company in Cincinnati.

Six ton Knox-Ajax truck with box body. Canada Foundry Co., Ltd., Toronto.

### The Clinton Truck.

Another prominent Canadian truck is the "Clinton," made by the Clinton Motor Car Co., Ltd., Clinton, Ont. This truck is fitted with what is known as the Unit System Power Plant. The motor, clutch and transmission are all housed in an aluminum case. This is supported by one trunnion in the front, attached to the front cross member of the truck, and by two trunnions at the rear, resting on bearing secured to the side members. The engine is fitted with a self starter. An interesting feature of the Clinton truck is the spring suspension, illustrated on page 236. The end of the spring is attached to a square block, which slides in a grooved frame of manganese bronze. Patents in Canada and the U. S. A. are pending on this device which is an exclusive feature of the Clinton truck. This arrangement of spring suspension displaces the system of shackles and rollers used on some cars. It ensures smooth running over very uneven surfaces and eliminates sudden jarring. The Clinton truck is built in 1-ton, 2-ton, and 3-ton sizes, while designs for a 5-ton truck are all complete. The latter size is built to order.

### The Canada Foundry Co. Truck.

The Canada Foundry Co., Ltd., Toronto, Ont., are about to take up the building of motor trucks. Before deciding to do so they went into the matter very thoroughly in order to satisy themselves as to the saving which might be expected by their use. With this end in view, the company built three trucks of 1½-ton, 3 tons and 5 tons capacity for use in their own business. They next proceeded to carry out a series of careful tests between horses and trucks, and as a result, it was found that for the same number of ton-miles, the 5-ton truck effected a net saving of about $18 a day over horses. This extremely satisfactory figure determined the company to take up the building of motor trucks and they at once sent representatives on a tour of inspection with a view to picking out a suitable model. Finally, an agreement was reached with the Knox Automobile Co., Springfield, Mass., by which the Canada Foundry Co. were given building rights. This truck will be known in Canada as the "Ajax."

The Knox motor has several interesting features, not the least of which is the water circulation. A centrifugal pump is driven by helical gears from the cam shaft through a flat safety spring coupling. The driving is done by this flat spring engaging two lugs on a disk fixed to the end of the pump spindle. The spring is, of course, stiff enough to take the drive under normal conditions; but

if the pump freezes or becomes clogged, the spring will snap by the lugs and, thus, any damage to the pump blades, shaft or gears will be avoided. The engine is fitted with a governor which can be set to any predetermined speed and then locked and sealed, thus preventing the operator from exceeding the speed set by his employer. Ignition troubles are eliminated by having a dual system, providing two sparking plugs in each cylinder and two methods of supplying current to either set, viz: dry battery and "Bosch" high tension magneto.

The Canada Foundry Co. expect to commence building these trucks before the end of this summer and will organize a department entirely devoted to this class of work.

## ELECTRIC LOCOMOTIVES.

EXPERIENCE with electric working on the New York, New Haven, and Hartford Railroad has now resulted in no less than seven kinds of locomotives being built. The original type was evolved to meet the troublesome conditions of the company's service into New York, where both alternating and direct currents are employed. For combined freight and passenger service there is a second type of locomotive, consisting of two sections, each having two driven axles in a rigid wheel base and a pony truck. This is used for single-phase operation in the Hoosac tunnel. There are also two experimental types, one modified from the second type and the other equipped with side rods. Still another type is a group of switching locomotives solely for alternating current, while another type is intended for combined freight and heavy passenger service. Finally, there is the new Colonial type designed particularly for fast, heavy passenger service.

In all, the company now possess 82 locomotives of these seven types. The Colonial locomotives are particularly interesting on account of the use of three separate wheel bases, consisting of two four-wheel radial trucks and two pairs of rigid drivers in the centre. Each radial truck has a pair of driving wheels and a pair of small pilot ones. Each pair of drivers is provided with two motors permanently connected in series, and having pinions geared to the same axle sleeve, by which several advantages in operation are obtained, including light construction and economy in the space required for the mechanism.

## ENGINEERING CLASSES IN WINNIPEG.

THE annual short courses in steam and gasoline engineering, which are being held for the fifth time, closed on June 28. The total number in attendance was sixty-two, most of whom are residents of Manitoba, while not a few have come all the way from Saskatchewan, and the class included men of all ages from 17 to 45. Thirty students received instruction in steam engineering under the direction of Professor L. J. Smith, B.S., assisted by R. Milne, B.S.A., and thirty took the gasoline engine course, under W. J. Gilmore, B.S., who is assisted by Russell Rice. These courses are carefully planned with the object of aiding, not only those who have already acquired some knowledge of steam or gasoline engines, but also those who have had no previous experience in their operation, and who realize that such knowledge is essential to success in modern farm management. The large engineering building at the Agricultural College is well equipped for the teaching of a practical course of this kind. It contains steam and gasoline engines, testing apparatus, valve models, and other appliances necessary for demonstration work.

In addition to the engines already at the College, arrangements have been made with the large tractor firms to have at least ten different tractors sent up for use during the latter part of the course, so that the students will have an opportunity of handling and becoming familiar with the various types of engines on the market.

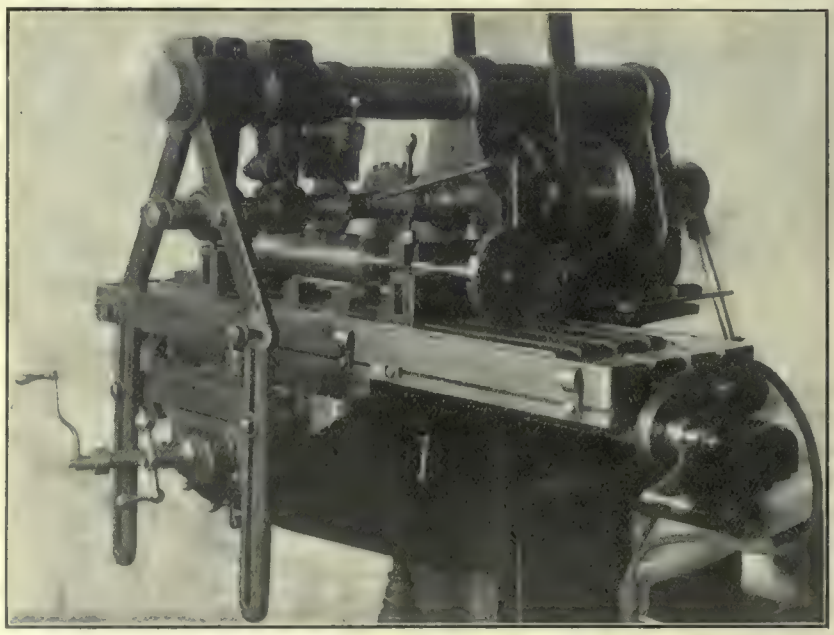
## A GOOD MILLING PERFORMANCE.

IN the headquarter shops of the Canada Machinery Corporation, Ltd., at Galt, Ont., no means are neglected by which production may be increased without departing from a high standard of workmanship. While the example of milling practice described and illustrated is but one of the many high speed performances to be seen there, it is nevertheless not the least interesting.

As shown, the work to be milled is a safety cylinder, or cutter head, for a wood working machine. It is made of .60 carbon steel, and the particular requirement is that of cutting slots 1½ inch deep by 1 inch wide. Each slot is cut at one operation, the feed being 4 inches per minute. The 6-inch diameter by 1 inch face cutter runs at 50 R.P.M., and has inserted teeth of "Saben Extra" high speed steel. The lubricant used is Mystic compound under pressure. The wire brush seen in contact with the cutter prevents the latter being jammed sideways by the cuttings. The larger milling cutter seen behind the work has nothing to do with the job in question. It will be generally agreed that the accomplishment of the task constitutes a very excellent performance, and speaks well not only for the cutter, but also for the milling machine. The latter is a No. 4 Cincinnati, and is by no means new, having seen a good many years of useful service.

Other good performances carried out in this shop are: (1)—Machining iron castings on a vertical boring mill at a cutting speed of 225 feet per minute, with ¼ inch cut and 1-16 inch feed. (2)—Turning a .35 carbon steel shaft, 9 inches diameter by 10 feet long, at 110 feet per minute, with ¼ inch cut and ⅛ inch feed. "Saben Extra" is used in both cases, the turning tool in the second example being ¾ x 1½ inches.

We are indebted to Mr. R. Power, general superintendent, for the above particulars and for the photograph from which our illustration is made.



A GOOD MILLING PERFORMANCE.

## RAILWAY SIGNALLING EXPERIMENTS.

INTERESTING experiments have recently been made near Birmingham, England, with a remarkable invention designed by Mr. H. von Kramer, with the object of preventing train collisons. The inventor's method is to have earth-buried wires laid alongside and parallel with each line of permanent way, which will communicate with the signal boxes all along the line. The guard's coach on the train is fitted with a coil framework, whence electricity emanates, connecting with the buried wire. The signal is picked up from either the wire or the train by a "detector," and automatically magnified, so that it is capable of operating a bell, hooter, or even a brake. In the guard's van are several electric "solenoids," erected on a marble slab, which are entirely automatic. When the detector operates, one of these rings a hooter, while another is used for pulling a lever in the van which puts on the brakes and stops the train. On the other hand, the train can signal from station to station, sending out a current which operates alarm bell and lamps.

If the signalman forgets to pull back a lever after a train has passed from one block section into another, this omission is automatically rectified by the current. If the train overruns a signal at danger it will be automatically stopped, and will not be able to proceed until a seal has been broken in the signal box, where the incident is recorded. This automatic signal will not be blindly relied upon by the engine driver and signalman, but rather increase their alertness, as they are certain of having their mistakes recorded without question of doubt. There is a recording instrument in each box which, when straight, indicates that all is right, but if any trouble occurs it goes up at the exact moment of the incident, and remains in a position of danger.

An outstanding feature of the invention is the extreme delicacy of the detector, which can be tuned to any pitch and only respond to a similarly tuned instrument. For instance, one tuned to 100 frequencies (vibrations) per second would not respond to others of even 95 or 105 frequencies. Moreover, the detector is tuneable to such an extent that the signalman can distinguish between goods, slow passenger, and fast trains. It is impossible for two trains to collide in the same section. If one gets in legitimately it is all right, but if a second runs over the block, both trains are automatically stopped. The experiments are being carried on over a ten-mile stretch of the Stratford and Midland Junction railway betwen Stratford and Kineton, and so far have proved a striking success.

## RAILROADS USING OIL.

THE consumption of fuel oil in the United States is steadily increasing, according to a report by David T. Day, of the United States Geological Survey, on the production of petroleum in 1910.

During that year, the quantity of fuel oil consumed amounted to 24,586,-108 barrels, as compared with 19,939,394 barrels in 1909, an increase of 23.3 per cent. In the vicinity of oil fields or where cheap water transportation can be secured, as along the Pacific coast, the cost of operating with oil is less than with coal. The use of oil, as a source of motive power for railroads, offers, aside from the use of electricity, the only certain guarantee of immunity from the hitherto generally prevalent fires along railroad rights of way. The adoption of oil as fuel on the C.M. and St. P. lines west of Butte and on the Great Northern west of Lavenworth, with a proposed extension eastward to Spokane this summer, gives great encouragement for the adoption of similar measures by the railroads of Canada on portions of their lines.

Already, the Canadian Pacific Railway announces the establishment of oil-burners, effective July 1, on that portion of its line in British Columbia between Kamloops and Field. The Esquimault and Nanaimo railway, running northward from Victoria on Vancouver Island is equipped with oil burning locomotives. The economy in the use of oil along the Pacific coast is further shown by its adoption, in place of coal, on the Canadian Pacific Railway and Grand Trunk Pacific steamers. No one thing would go so far to prevent continued destruction of the magnificent forests of British Columbia as the use of oil on locomotives running through forested portions of that Province. The hardship upon the railroad companies would not be material, and, in comparison with the tremendous public interest at stake, would be infinitesimal.

## ELECTRIC HEATING.

CHEAP hydro-electric power generated on the Snake River has caused the rapid development of the city of Twin Falls, Idaho, and has rendered practicable the electric heating of buildings. In the vicinity of Twin Falls electric heating units to the extent of almost 1,000 k.w connected load have been installed in place of steam radiators. A six-room house uses $70 to $100 worth of electrical energy during the season of eight months, and a building having stores and offices on the first floor and a ball room on the second story uses 100 k. w. at a cost of $625 for the season. Three-phase current is brought into the latter building at 2,300 volts, and is transformed to 220 volts for use in 40 electric radiators and a water tank heater, which keeps the water continually at the boiling point through thermostatic control. The size of the building is 50 feet by 120 feet, and the electrical equipment, exclusive of the transformers, which were supplied by the power company, cost approximately $1,000.

## ECONOMICAL WORKING OF STEAM BOILERS.

A DEVICE for the consumption of smoke in boiler furnaces and for economizing the heat, installed in a silk mills in Matteawan, N. Y., by the Furnace Gas Consumer Company of Newburgh, N. Y., consists of a number of tubes made of refractory clay, which are placed end to end in the furnace behind the bridge wall in such a manner that the draught from the fire passes through them. When the fire is incandescent, the tubes are stated to absorb a large amount of heat, which is given out when fresh fuel is charged into the furnace, so that the gases therefrom are completely consumed. During tests with a 100 h.p. boiler, the heat from the tubes and from the asbestos packing between them and the boiler sufficed to generate sufficient steam to enable the boiler to be worked at full load for 12 min., while with a banked fire overnight, the pressure available in the morning has been more than double that which has been obtainable under ordinary conditions.

## STAY BOLT THREADS.

ACCORDING to inquiries made by the "**American Machinist**" among locomotive builders, it is found that in nearly all cases stay-bolts for locomotive boilers are being made with the Whitworth thread. This is done for two reasons:— Specifications for locomotives for foreign countries always mentioned Whitworth threads, and boiler makers fell into the habit of making their taps and dies with rounded points, so that they were practically getting Whitworth conditions. Even with the United States standard thread the stay-bolt tap is very apt to become rounded on the top, as the boiler sheets are often quite hard.

**Fraser and Chalmers, Ltd.**, 4 Phillips Place, Montreal, have been appointed agents for the Terry Steam Turbine Co., Hartford, Conn., in Eastern Canada, which includes Quebec and the Maritime Provinces.

## STANDARD PARTS FOR PILLAR DIES.

By L. E. Gehman.

THE writer of this article realizes that every manufacturer who has a punch press department in his plant is trying to standardize his punch and die parts so that they can be manufactured at less cost and placed in the machine in as short a time as possible.

While employed on the mechanical staff of a large typewriter manufacturing company in the States, I was called upon by the management to standardize all punch and die parts as well as subpresses, so that any punch and die could be used in any press that was heavy enough for the operation. Believing, therefore, that the readers of Canadian Machinery are always interested in the most modern developments, the writer feels sure that a complete description of the punch and die practice of this company will appeal to them, as there is embodied many novel and interesting features.

### Sub-Press Castings for Blanking Dies.

Fig. 1 shows the design of sub-press base and plunger castings for blanking dies, and the tabulated list following shows the dimensions of the four stock sizes, which are of correct proportion, and might be used in other shops. This, however, is a larger variety than necessary for most shops. It was found necessary to provide this range of sizes for handling all the blanks produced, which ranged within wide limits.

All punches and dies are of the pillar sub-press type, as time saved setting-up, and the fact that there is no danger of the punch and die getting out of alignment, more than make up for the added cost over the common open style punch and die. The base casting is secured to the bolster on the press by plain bolts; slots being provided for this purpose. Plain guide pins are used, one being made smaller than the other to avoid the possibility of putting the punch and die together incorrectly. The plain guide pins are cheaper than those provided with oil grooves, and are more rigid than those set into bushings in the base. The plunger is secured to the ram of the press by a novel method; a description of which is really the most interesting part of this article, and the most important point in the standardization of the punches and dies in this particular shop. A V-slot is provided, made to gauge to fit a V-block on the adapter, which is applied to every press in the shop. By this means it is possible to use any punch and die on any press in the plant. This fact is of the utmost importance, as usually when designing a punch and die it is necessary to designate the presss on which it is to be used, and make the punch and die to fit same.

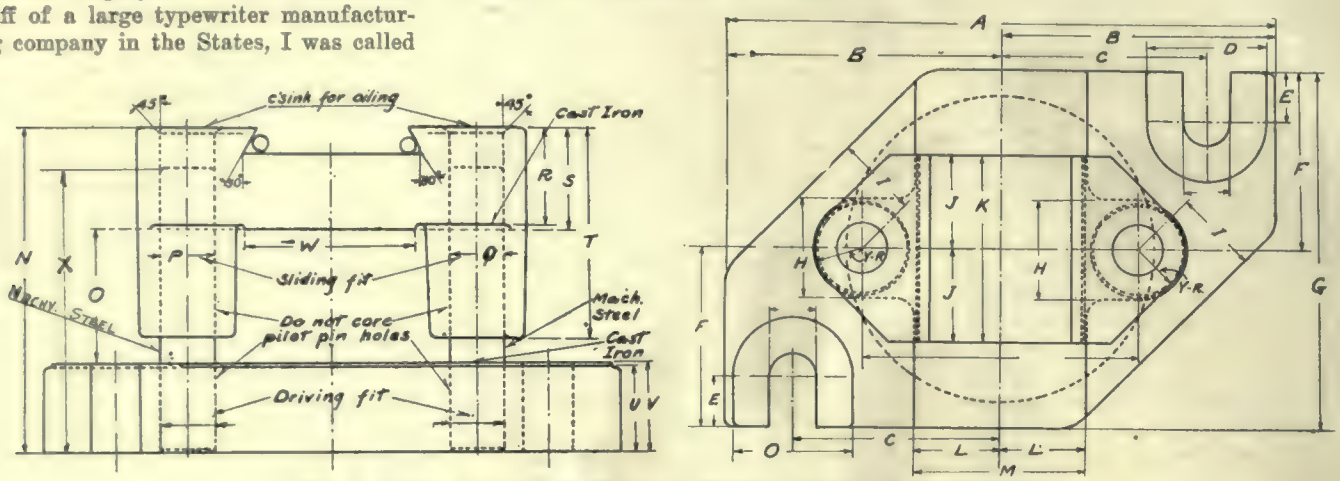



Fig. 1—Design of Sub-press Base and Plunger Castings for Blanking Dies.

Before the adapters were attached to the presses they were all made to have the same working clearance between the end of the ram when down and the bed of the press. This was done by finding the press which has the least amount of room under the ram, with the adjustment about two-thirds of the way up. In the smallest press this was found to be 5⅛ inches, using a one-inch bolster. All the other presses were brought to this figure by using suitable adapters and thicker bolsters; thus, the result was obtained of being able to use any punch and die made in any press, provided only that the press was heavy enough to handle the work.

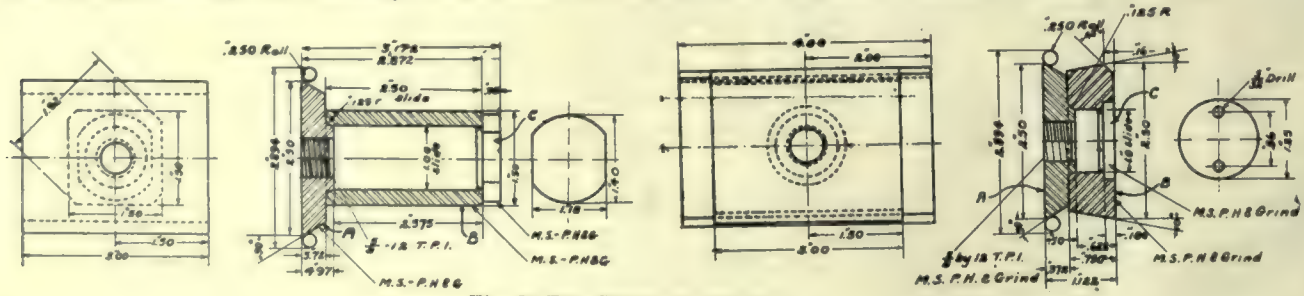



Fig. 2—Two Styles of Adapters.

### Styles of Adapters.

Fig. 2 shows two styles of adapters. These adapters were made in several different styles to fit different presses. It will be seen that they consist of a V-block (A) fitting the slot in the top of the plunger, which is secured to the body (B) by threaded portion of part (C). Thus, it can be seen that the V-block may be swung to any angle without loosening the screws which secure the adapter to the ram, or removing the adapter. As every press in the shop is equipped with one of these adapters, they are considered part of the press, and are not ordinarily removed from it.

### Castings for Bending Dies.

Fig 3 shows the style of base and plunger castings adopted for bending dies, made in two sizes (see tabulated list). These are of open construction, having both the guide pins in the back. A punch and die fitted to one of these sets of castings is easy to load, the front being entirely open. This style is, there-

fore, far superior to those with guide pins on the sides for bending purposes.

### Blanking Punch and Die.

Referring to Fig. 4, there is shown a sample blanking punch and dies made in this shop, which embodies many desirable features, being of economical and efficient design and standardized in more ways than one. The stock handled in this particular punch and die is .041 inch thick, cold rolled soft steel. The die consists of a piece (15) of Brown and Sharpe ground stock ¼ inch thick, hardened and set into a block of machine steel (13), and secured to the base casting by screws (20) and dowels (19). The tool steel block is fastened to the machine steel block by screws and dowels (30 and 28). In the No. 1 and 2 presses, the parts (15 and 13) are of standard thickness, ¼ and ½ inch respectively, but the length and width are optional, depending on the job in hand.

The B & S ground stock comes in regular widths and thicknesses, ready ground to size, and no further machine work is required to fit the die made from this material to the machine steel block. The economy of this construction is easily seen. With the inserted ¼ inch plates, stock 3-32 inch thick can be satisfactorily blanked, and has been used for ⅛ inch stock. When the stock is unusually thick for a small blank, a solid tool steel block is used. With the No. 3 and 4 presses, ⅜ inch inserted plates are used on account of the blanks being generally thicker, as they are larger. The stop (29) is made of machine steel and pack hardened. It is not made standard as to size, but to suit the particular job on hand, and is generally in shape a straight piece, but on account of its position, the blank, in relation with the strip of stock in the die shown here, is provided with a projecting end for clearing the hole in the stripper. The stop swings on a pin (27) of hardened drill rod, screwed into the stripper plate, and is also provided with an adjusting screw (25) and check nut (24), by which any slight adjustment may be made, rendering unnecessary the use of extreme accuracy in locating the stop in the first place. The extreme simplicity of this form of stop makes it cost probably about one quarter as much to make as the stops in general use. Of the guide

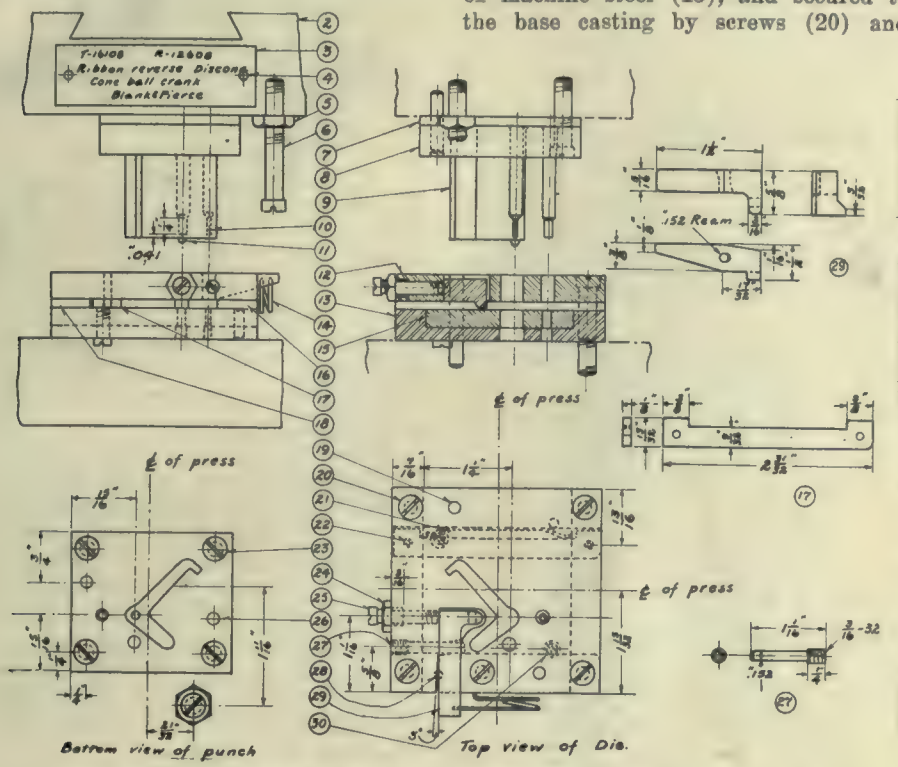



Fig. 4—Sample Blanking Punch and Dies.

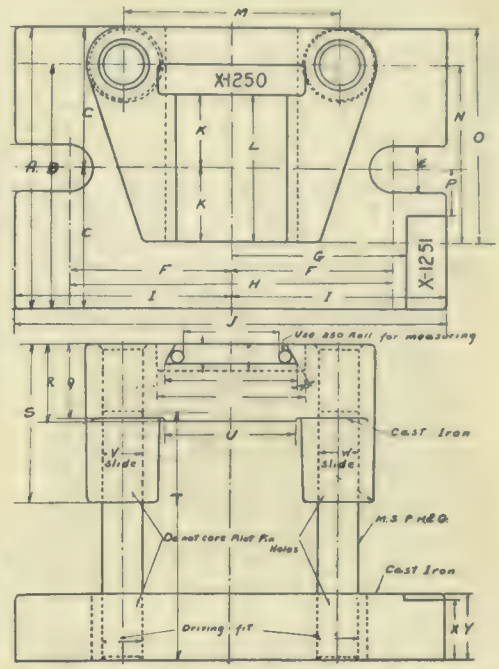



Fig. 3—Base and Plunger Castings for Bending Dies.

| Fig. 1 | No. 1 | No. 2 | No. 3 | No. 4 |
|---|---|---|---|---|
| A | 8 | 8 | 11¼ | 14 |
| B | 4 | 4 | 5⅜ | 7 |
| C | 3 | 3 | 4½ | 3½ |
| D | 1¾ | 1¾ | 1¾ | 1¾ |
| E | ¾ | ¾ | ¾ | ¾ |
| F | 2⅛ | 2⅛ | 4⅛ | 5⅛ |
| G | 5¼ | 5¼ | 8¼ | 11¼ |
| H | 1 7/16 | 2 | 2¼ | 2¼ |
| I | 1 3/16 | 1 | 1⅛ | 1⅛ |
| J | 1½ | 1½ | 3½ | 6½ |
| K | 2¾ | 2¾ | 7¼ | 13 |
| L | 1¼ | 1 15/16 | 3 5/16 | 3 5/16 |
| M | 2½ | 3 7/8 | 6⅝ | 6⅝ |
| N | 5⅛ | 5⅛ | 5⅛ | 5⅛ |
| O | 2 7/16 | 2 7/16 | 2 7/16 | 2 7/16 |
| P | ⅜ | 1 | 1⅛ | 1⅛ |
| Q | ⅝ | 15/16 | 1 5/16 | 1 5/16 |
| R | 1⅜ | 1⅜ | 1⅜ | 1⅜ |
| S | 1 7/16 | 1 7/16 | 1 7/16 | 1 7/16 |
| T | 2 15/16 | 2 15/16 | 2 15/16 | 2 15/16 |
| U | 1 3/16 | 1 3/16 | 1 3/16 | 1 3/16 |
| V | 1¼ | 1¼ | 1¼ | 1¼ |
| W | 2⅜ | 3⅜ | 6⅜ | 6⅜ |
| X | 4¼ | 4¼ | 4¼ | 4¼ |
| Y | 11/16 | 15/16 | 1 1/16 | 1⅛ |
| Z | | | | |

Tabulated List Showing 4 Stock Sizes for Blanking Die Castings.

| | Qty. | Finished Size | Material |
|---|---|---|---|
| 2 | 1 | Std Press No. 2 Patt Nos. X-1020 & X-1021 | |
| 3 | 1 | 1/16 x ⅜ x 3 | Soft C.R.S. |
| 4 | 2 | ¼-40 Screw | E-206 |
| 5 | 1 | ¼-20 Hex. check nut | |
| 6 | 1 | ¼-20 x 1¼ | Fil. Hd. Sc. |
| 7 | 1 | ½ x 2 x 2 1/16 | M.S.P.H. |
| 8 | 1 | ½ x 2 x 2 1/16 | M.S. |
| 9 | 1 | 4 1/32 x 1 3/16 x 1⅛ | T.S. H & G |
| 10 | 2 | ⅜ Diam. x 1 19/32 | D.R.H. |
| 11 | 1 | ¼ do. x 7/16 | do. |
| 12 | 1 | ½ x 2 1/16 x 3 | M.S. |
| 13 | 1 | 1/16 x 2 1/16 x 3 | do |
| 14 | 1 | .043 Diam. | Music Wire |
| 15 | 1 | ¼ x 2½ x 2 1/16 | B.B.S. Gr. stock |
| 16 | 1 | ⅛ x 1/16 x 3 | M.S.C.H |
| 17 | 1 | ⅛ x 13/32 x 2 11/32 | do |
| 18 | 1 | ¼ x 1/16 x 3 | M.S. |
| 19 | 2 | 3/16 Diam. x 1 5/16 | D.R. |
| 20 | 5 | ¼-20 by 1¼ | Fil. Hd. Ss. |
| 21 | 1 | 1/32 x ⅜ x 2 1/16 | T.S.S.T. |
| 22 | 2 | 3/32 Diam. x ⅜ | D.R. |
| 23 | 4 | ¼-20 x 1 | Fil. Hd. Sc |
| 24 | 1 | 3/32 - 32 Hex. check nut | |
| 25 | 1 | 1/16 - 32 x ⅜ | Fil. Hd. Sc. |
| 26 | 2 | 3/16 Diam. x ⅜ | D.R. |
| 27 | 1 | 1/16 do. x 1 1/16 | D.R.H. |
| 28 | 2 | ¼ do. x 1/16 | D.R. |
| 29 | 1 | ¼ x ⅜ x 1⅜ | M.S.P.H. |
| 30 | 2 | ¼-32 x 7/16 | Fil. Hd. Sc. |

Fig. 5—Bill of Material for Sample Blanking Punch and Dies.

strips (16, 17 and 18), one (17) is moveable on pins (22), being provided with a flat spring (21), so that it presses the stock firmly against the front guide strip (16). These are made of machine steel and case hardened. The stripper plate (12), of machine steel, is of standard thickness, ⅜ inch, and of size to suit the die.

Referring to the blanking punch (9), it will be seen that it, as well as the piercing punches, are headed over and held under in a ½ inch machine steel plate (8) with a ⅛ inch pack hardened plate (7) behind it. This is an excellent construction, and it will be noticed that the piercing punches are only formed for a short length to the diameter they are to pierce; being made of considerably larger stock for added strength. The pilot shown here is made solid instead of having a spring behind it, this being in most cases considered a superior construction. This point is, however, open to question.

The action pin for the stop is simply a ¼ inch filister head screw, screwed into the plunger casting, and having a check nut for adjustment. Plate 3 is screwed to the front of the plunger casting, with the part number and name of the piece to be made in the punch and die.

The use of a bill of material for parts not detailed is a good idea, but the one shown for Fig. 4 is an improved style, as all parts of the punch and die are called for here, whether detailed or not, so that the foreman of the toolroom can write his material orders from it, without the possibility of missing any of the parts. Reference figures are placed down the middle of the sheet in a straight row, making it easy to identify any particular piece.

As all the parts are called for in the bill of material, it is necessary to detail but three as shown; other figures where necessary being placed directly on the assembly drawing. As the most of the parts are square or regular shapes, the dimensions given on the bill of material are sufficient. The foregoing examples show modern and approved practice.

## INDUSTRIAL ACCIDENTS.

ACCORDING to the industrial accident record of the Department of Labor, 62 persons were killed and 249 injured during the month of June in the course of their employment. A comparison with the records of the previous month and of June, 1911, shows that there were 28 fewer fatalities than in May, and 30 less than in June, 1911. Of the non-fatal accidents, there were 8 more recorded than in May, and 137 more than in June, 1911. There were but 2 accidents recorded involving the death of more than one workman. One occurred on June 1, by which 8 construction laborers were killed during blasting operations on railway construction work near Stones' Corners, Ont., and the other a head-on collision of railway trains near Nipigon, Ont., in which 4 railway employes were killed.

## U.S. FOUNDRY AND MACHINE SHOP CENSUS.

ACCORDING to statistics recently published by the United States Census Bureau, there were 13,253 foundry and machine shop establishments in the United States, employing 615,486 persons, when the last census was taken. Of the total 9,851 were proprietors and members of firms, 21,754 were salaried officers, superintendents and managers, and 52,869 were men and women clerks. The average number of wage earners was 531,011. The value of products was $1,228,475,148, and the value added by manufacturing processes or the difference between the value of the finished products and the cost of the raw materials, was $688,464,000. Pennsylvania took the first place with an average of 86.821 wage-earners, $210,746,257 value of products, and $109,735,517 value added by manufacture. New York held the second place with $154,370,364 value of products and $92,749,146 value added by manufacture, but it was third in regard to its average of 64.066 wage earners.

| FIG 3 | No 1 | No 2 |
|---|---|---|
| A | 5 1/4 | 5 3/4 |
| B | 4 9/16 | 4 13/16 |
| C | 2 5/8 | 2 7/8 |
| D | 15/16 | 15/16 |
| E | 7/8 | 7/8 |
| F | 3 | 3 |
| G | 3 1/4 | 3 1/4 |
| H | 6 | 6 |
| I | 4 | 4 |
| J | 8 | 8 |
| K | 1 3/8 | 1 3/8 |
| L | 2 3/4 | 3 3/8 |
| M | 4 | 6 |
| N | 3 5/16 | 3 15/16 |
| O | 4 | 4 7/8 |
| P | 7/8 | 1 1/4 |
| Q | 1 3/8 | 1 3/8 |
| R | 1 7/16 | 1 7/16 |
| S | 2 15/16 | 2 15/16 |
| T | 4 5/8 | 4 5/8 |
| U | 2 7/16 | 3 7/8 |
| V | 3/4 | 3/4 |
| W | 23/32 | 23/32 |
| X | 1 1/8 | 1 1/8 |
| Y | 1 1/4 | 1 1/4 |

Castings for Bending Dies.

## PREVENTING SHORT-PAID POSTAGE.

THE Daily Consular and Trade Report contains the following letter, which shows how one firm has endeavored to master the situation, regarding short-paid postage.

"All stenographers are trained from the time they begin work at our place to use for domestic mail, United States light-colored stamped envelopes. All letters addressed to foreign countries must have a blue envelope without a postage stamp on it. Every evening the clerk who has charge of attaching stamps takes the letters in blue envelopes and after first selecting those that go to foreign countries where two cents is sufficient, such as Mexico, Canada, Cuba, Great Britain and Germany, he affixes five cent stamps to all other blue envelopes." Canadian and American manufacturers should try and escape by some such means as suggested the many criticisms made by foreigners that letters are received short of postage, especially when the penalty of such short postage is often three or four times greater than what the postage would otherwise be.

## LARGEST LOCOMOTIVE IN THE WORLD.

WHAT will be the largest and most powerful locomotives yet constructed are now nearing completion in the shops of the American Locomotive Co. The locomotives are intended for use on the Virginian Railroad and are of the Mallet compound type. Each engine will weigh in working order, 540,000 pounds with 479,200 pounds on drivers. The combined weight of the engine and tender will be 752,000 pounds. The total length of the engine overall is 65 ft. 11¼ in. and the total length of wheel base is 57 ft. 4 in. These engines will have a tractive power of 115,000 pounds, or 60 per cent. more than the pioneer of this type built in America for the Baltimore & Ohio Railroad. The American Locomotive Co. system of compounding enables the tractive power at slow speeds to be further increased to 138,000 pounds when working the engine simple.

## MALLET TYPE LOCOMOTIVES.

ACCORDING to the Railway Gazette there are at present something like 500 locomotives of the Mallet type in service on the different railways in the United States, Canada and Mexico.

These include practically all possible wheel arrangements and boiler designs, and, speaking in a general sense, they are working under similar conditions. While it is impossible to obtain in any considerable number of cases, the cost in money of both the Mallets and the types they have replaced, it is yet possible to glean facts concerning the majority of the locomotives in service, which permit fair conclusions being drawn as to the relative value of different types.

Mallet locomotives have in very many cases taken the place of 2-8-0 engines, and the investigation has proved that the former haul from 21 per cent, to 92 per cent. greater loads than the latter, and, in fact, that two of them will do the work for which three "Consolidations" are ordinarily needed. It is nearly on this ratio that the number of engines has been reduced on some lines. The mere reduction in the number of trains on the road, even though they be longer and heavier, introduces a very large saving from every standpoint, and one which it is difficult to estimate accurately. There is, of course, the reduction in wages of engine and train crews, and as regards fuel consumption the Mallets show an average saving of 3 lb. per 100 ton-miles.

## NATIONAL POWER HOUSES.

PRESENT-day practice does not represent a final solution of the electricity supply problem. The multiplicity of power houses with their respective staffs is not economical, and the abilities of engineers at present engaged in running comparatively small generating stations would find full play in other directions if a bulk supply were available at a price low enough to secure its exclusive use in all domestic and industrial operations. The complete realization of such an object would be possible only by erecting upon the coal fields of the country, electric generating stations on a much bigger scale than anything yet attempted. From an economic point of view no question was more important in this or any country than the efficient use of coal, and no economy was so far-reaching in its effects as that of fuel, which constituted the vital force of almost every branch of industry. A gigantic scheme of this character called for the active co-operation of the Government with the existing supply authorities, and there were few home problems that could be more profitably dealt with by the legislature, or that would confer greater benefits upon the nation.

National power houses, built on the coalfields and on other sites to which coal could be cheaply transported by water, would supply the power for all extensions in existing areas, and would gradually assume the whole of the supply, as the plants in local works became worn out or obsolete. Such power houses would be equipped with high-pressure steam turbo-generators of, say, 25,000 and 50,000 kw. sizes. They would be inter-connected and distribution effected at, say, 100,000 volts to sub-stations. Transmission at this pressure was already successfully accomplished in Colorado under the most severe conditions.

### The Question of Steam Generation.

It was the generation of steam that called for a radical change in present-day practice. Engineers had too long been content to use boiler plants, furnishing on an average of from 2lb. to to 3lb. of steam an hour per square foot of heating surface. Such practice involved the use of enormous boiler installations, out of all proportion to the size of the generating plants, and reference to the layouts of modern works, equipped with from 10,000 to 20,000 kw. units of power, showed a separate boiler house for each generating plant. These boiler houses were built end-on to the power house, and imposed a heavy capital cost for boilers, buildings, flues, and chimneys. They also involved heavy losses in boiler, steam pipe, and flue radiation.

**THE ADVERTISING SECTION**

**The advertising pages of a trade journal introduce to its subscribers, purchaser and operator, the manufacturer whose product has been designed and developed to further their mutual interests. An intelligent perusal of the advertisements appearing in each issue of this journal enables definite comparisons being made between individual units of already-installed equipment and those recently placed on the market, for which more or less warranted claim is made regarding improved quality and quantity output.**

The solution of these difficulties appeared to lie in the introduction of gas firing by means of flameless surface combustion on the lines first discovered by Sir Humphrey Davy, and more recently developed and described by Professor Bone. So far as investigations have gone at present, it was shown that an evaporative duty from boilers exceeding 20 lb. of steam per square foot of heating surface could be obtained easily with a thermal efficiency corresponding to the transmission to the water in the boiler of nearly 95 per cent. of the energy represented by the net calorific value of gas. At a slightly lower efficiency the evaporation might be increased from 20 lbs. of steam to 30 lbs. of steam per square foot. On these high duties the internal boiler surfaces were stated to be self-cleaning, and the scale in thin flakes became detached and was deposited in the bottom of the boiler. The boiler installation would be comparatively small and the steam range short, as all the auxiliaries would be driven by internal combustion engines.

### The Supply of Low-Pressure Steam.

Many of the largest industries in the country—probably the cotton, woollen, dyeing, chemical, distilling, and brewing trades used immense quantities of low pressure steam in their various manufacturing processes. Steam for such industries could be supplied from the national power houses at less cost than it could be produced by the manufacturers themselves. Irrespective of the large economies and advantages effected by a distribution of power on national lines, such a market for low pressure steam would have a startling effect upon the economy of electrical production, as it would at once eliminate the enormous losses involved in condensers. Just as the Niagara and other large hydro-electric schemes, by reason of cheap power, attracted and promoted industries in their immediate vicinity, so national electric power houses, able to supply vast quantities of low-pressure steam at cheap rates, would attract and promote in their immediate vicinity those industries wherein steam formed one of the chief items in the manufacturing process. It was remarkable that business in this direction had not already been developed by power stations operating in the textile districts. In many areas it would be much better to invest capital in thus selling the condenser losses than in the erection of costly cooling towers and condensing plants.

There were many district steam-heating schemes in operation in America, and in numbers of instances the revenue from the heat distribution was larger than that from the sale of electric power. One of the most convincing proofs of the value of a low-pressure steam-heating business was furnished in the case of Lockport, New York, where approximately 300 buildings were supplied with heat during the colder months of the year. The company purchased electricity in bulk from Niagara Falls at one quarter of a cent per kw. hour; nevertheless, in the cold season, with coal costing $3.18 per ton (English ton), it paid the company to operate their own local steam generating plant and to sell the exhaust steam in the city.

From the heating business alone, during the cold season of about 5,400 hours, they derived an income approximately $46,875.

The foregoing is an abstract from the presidential address delivered recently before the Incorporated Municipal Association, at Leeds, England.

## PROFIT SHARING IN BRITAIN.

IN the abstract of labor statistics for the United Kingdom, recently issued by the Board of Trade, particulars are given of the history of the profit-sharing system. It appears that up to June 30th, 1911, a total of 232 schemes had been started by firms, but at that date only 76 were known to be still in operation. In the four years 1889-92 as many as 84 schemes were inaugurated, only 16 of which have survived. Later experiments seem to have proved more successful; the whole of the 16 begun in 1908 and 11 of the 13 launched in 1909 being still in existence. Of the 153 schemes dropped. 40 were abandoned owing to dissatisfaction of employers with the results; 21 on account of losses or want of success; 21 because of liquidation or dissolution; 17 on account of changes in or transfer of business, and 10 owing to the apathy of the workpeople.

## NEW GALVANIZING PROCESSES.

PROBABLY none of the three galvanizing processes which are in use today will be supplanted, as each, according to an article in "Stahl und Eisen," has its special advantages. The old process of dipping the articles in a hot bath of molten zinc now gives better results by the introduction of brick baths without iron lining and an increase in the quantity of surplus metal used. The electrolytic process has also been improved by the use of a more reliable and lasting electrolyte and the employment of a current of greater density to produce a deposit with a brilliant surface.

Good results have also been attained by the dry process, or Sherardisation. In this process the previously pickled articles are heated, without access of air, in zinc dust, at a temperature of from 150 cent. to 200 degrees below the melting point of zinc. An improved method, introduced by F. W. Gauntlett, consists in replacing about 80 or 90 per cent. of the pure zinc dust with quartz sand, by which balling, foliation, and accidental combustion of the zinc is avoided. The process is carried on in a revolving cylinder. An iron-zinc alloy is first formed on the surface, on which afterwards a coating of pure zinc adheres. Iron, coated by this method, may be rolled and drawn or polished without the coating breaking off.

## CANADIAN AGRICULTURAL IMPLEMENTS FOR RUSSIA.

ACCORDING to the official Commercial Gazette of St. Petersburg of January last, Russia consumes approximately some $46,350,000 worth of agricultural machinery. Of this amount, the imports from abroad are valued at $20.600,000, of which the United States supplied $6,849,500, chiefly reaping machinery. Owing to the inadequate production of reaping machinery at home, Russia cannot as yet dispense with the foreign supply. As a result of the action of the United States in terminating the Russo-American Treaty of Commerce, at the end of the present year, the Russian Board of Agriculture now proposes to direct its attention to other countries as a source of supply of agricultural implements and machinery. To this end, the Board proposes to authorize the agent of the Russian Board of Agriculture in the United States to personally investigate the condition of production of agricultural implements and machinery in the big works of Canada and to purchase types of same for trial in Russia.

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## FACTORY ILLUMINATION.

A SPECIAL report on illumination in factories states that as regards artificial illumination there seems to be little to choose between lighting by electric glow lamps and by modern systems of incandescent gas. Electric light has the advantage of being constant and requiring little attention beyond the systematic dusting and renewal of lamps. The gas systems generally produce a whiter and more powerful light than electric current, but the units are apt to vary much in efficiency, owing to the liability of the mantle to deteriorate. Careful attention, therefore, is required to replace any that show signs of weakness. Electric light, of course, causes no vitiation of the atmosphere; but in the modern systems of gas lighting the amount of gas burnt is so small and the combustion so complete that the effect on the air is minimized. For the perfect local lighting of any point of work the three following conditions must be fulfilled:—(1) The illumination must be adequate; (2) "glare" effects must be absent; and (3) no troublesome shadows must be cast on the work.

## NOVA SCOTIA STEEL & COAL CO.

THE June output of the Nova Scotia Steel & Coal Co., was the largest this year for coal, pig iron and steel ingots. The amount of coal was 71,900 tons, that of pig iron 7,074 tons, and that of steel ingots 7,450 tons. The new hydraulic fluid compression plant at Sydney Mines was started on July 1, and proved remarkably efficient, four fluid ingots being simultaneously produced by the application of 1,250 tons pressure. The plant worked perfectly.

## SINGLE-PHASE MOTORS AND CONTROL SYSTEMS.

THERE have recently been numerous improvements in single-phase motors and control systems as used on American railways. The most recent single-phase installation is the New York, Westchester and Boston Railway. The car motors on this line are cooled by air supplied by an external fan, resulting in a continuous rating of over 75 per cent. of the nominal or one-hour rating. The compensating winding is short-circuited, giving inductive compensation and making the insulation strain to earth negligible. The preventive leads are of an improved design, and the control includes but seven low-voltage unit switches, even though arranged for automatic acceleration.

During the past eighteen months, the American single-phase railways in operation and new single-phase installations have ordered car equipments aggregating 77,000 horse-power, which would correspond to the motive power on over 250 cars each equipped with four 75 horse-power motors.

**The Manitoba Windmill & Pump Co., Brandon,** have changed their name to that of "**Manitoba Engines, Ltd.**" The new name will more appropriately express the product of the company, as their main line of manufacture is now gasoline engines and pumps.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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Vol. VIII. AUGUST, 1912 No. 8


## CANADA'S WEST.

THERE appears to exist in the minds of a number of reputably intelligent people the opinion that the citizens of eastern manufacturing and older established Canada, are altogether ignorant of and asleep to the developments, achievements, requirements and outlook of their western brethren, who devote their energies to the extraction of the fruits and treasures of Mother Earth. Now and then there is borne in upon us a tale of discovery to which we prick our ears and on which we endeavor to concentrate our vision, if perchance, in pageant array, our imagination might witness the unfolded wonders and we be impressed intellectually and stirred physically to a sense of our stupendous ignorance of this land, its men, matter, and mighty improvements.

On analysis, however, and due largely to the efforts of the daily press in keeping us informed, we find much of the data furnished by the scribes who make long-interval, spasmodic dashes through a greater or lesser extent of territory, to savour somewhat of "caul kail het again." It seems to us that if the people who retail such clap-trap as "lack of perception of their duties and privileges on the part of Canadian manufacturers" would keep themselves posted daily, which can be done on the expenditure of a few cents, they would find that this new country is moving forward en masse, intimately in touch with and meeting in a reciprocal attitude the demands of its many sections and the individuals composing them.

Little fault can be found with the Canadian manufacturer, or for that matter, with his British and American brothers, on the score of alertness to and appreciation of the situation, and we may not underrate, much less slight the enterprise being shown by the East in catering to the requirements of the West. We commend, however, to the attention of our great railroad corporations, a somewhat higher sense of popular duty as the basis of their business code, a proceeding which would militate little against their stockholders' interests and contribute much to the manufacturers' distributing and therefore greater output facilities.

## INDUSTRIAL TROUBLES.

LABOR troubles in varying degree of acuteness loom largely in the industrial sphere, the world over, and their cause, determined by keen observers who have studied the problem, is neither more nor less than the desire of those popularly known as the working classes toward a general betterment of their condition. It has been said that extreme poverty and, still less, grab of capital's prerogative, were conspicuous by their absence as contributing factors in the declaration of those strikes with their attendant misery, which have recently convulsed the commercial life of Great Britain and other countries, the former more particularly. The working classes have been raising their ideals upon a falling purchasing power, and the attainment of any ideal usually costs money.

There is more good than bad in the existing labor unrest, and it appears to be much easier to over-estimate the alarming nature of the movement than to overestimate the boundless possibilities of the voluntary co-operative spirit and the growth of a corporate sense. It is becoming more generally realized that industrial peace will be the outcome of an increasingly wise development of trade unions rather than of parliamentary legislation. Education, sagacity and tact are qualifications to be desired in officers and rank and file alike of labor organizations, and coincident with the degree attainment of these by the individual will peaceful achievement be recorded.

The developments taking place in every department of human thought and effort are so radical and rapid, that it is little wonder that we sometimes get out of mesh with our fellows, yet there is no reason why more attention should not be directed by employer and employe to the question of automatically adjusting themselves to each new condition as it arises. There is no lack of past experience to guide us, and to which we may turn and note that industrial enterprise is a great concentrated forward movement whose leaders in any section may not dare be tyrannous or dictatorial. We are of opinion, that never before in the history of the world has there been less contempt for and a more sincerely conscientious appreciation of the place and power of capital and labor by their respective and heretofore opposing forces than what is now merging into being as the result of more or less recent happenings. It is the privilege of Canada to benefit by the experience of older countries, and of her taking to heart the lessons and profiting thereby, we are supremely hopeful.

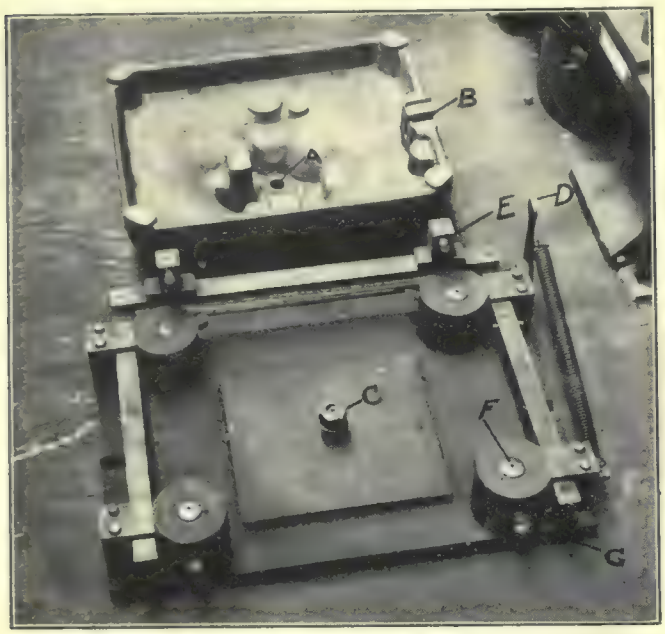
# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

### SPECIAL MILLING FIXTURE.

By Avery E. Granville.

WE build a small machine which has a cast iron base, like that shown bottom side up in the accompanying half-tone. The top of this casting has a raised boss about four inches square in the centre, which is first milled off flat, and a ¾-inch hole drilled in its centre, which comes through at (A.) The bottom of the base must be milled parallel to the top of the boss, and a slot must be milled at (B) as near parallel to one side as the rough casting will permit. This is done in the fixture shown.




A Special Milling Fixture.

The nut is removed from stud (C) and the casting set over it, with the stud projecting through the hole. The nut and washer are now put on and run down with the fingers. Next, the lever (D) is released, which brings the two pins (E) against the side of the casting, lining it up. The pins (F) which have springs under them, are now released by loosening the set screws (G), and they butt up against the underside of the rough casting. The set screws are then tightened, and the pins form a solid support for the uneven surface against which they rest. Finally, the nut in the centre is given a turn with a wrench, and the work is ready to be milled at one cut, using a gang of cutters.

After the casting has been milled and removed, the set screws (G) are loosened and the pins (F) are pushed down as far as they will go, in order to make room for any possible bulges in the next casting. Then, after the casting is in place the pins are again released as described.

Very rapid work can be done with this fixture, and the work has no tendency to chatter or spring away from the cutters.

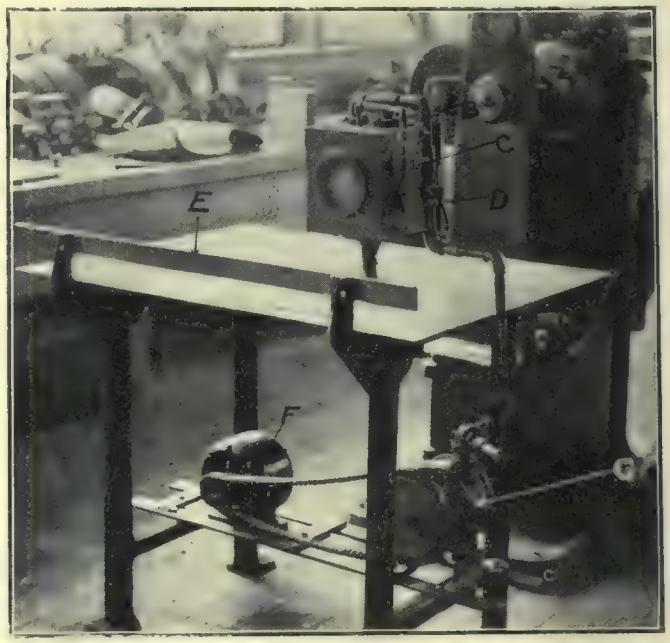
### A TOOL-ROOM FURNACE.

By Avery E. Granville.

ONE of the handiest things we have in our tool-room is the small furnace shown in the accompanying half-tone. At the time the picture was taken the gasoline pipe had been disconnected to make some repairs, but when in use the pipe is connected at (A). There is a small stop-cock at (B) and a valve between the gasoline and air pipes at (C). There is also an air-cock at (D), and by using these valves as wanted, a large or small flame of intense or moderate heat may be easily obtained. The range of usefulness is almost unlimited.

We heat soldering irons by placing the points in the furnace and laying the handles on the rail (E). The ends of short rods are heated in the same way. High speed or carbon steel tools for the lathe, shaper or planer are easily heated by it for hardening, as well as other work, such as small punches or dies. Of course, this kind of furnace is not suitable for die work requiring special care. For that class of work we have a regular heating furnace made for the purpose.

The legs of the table are of cast iron with a boiler iron top bolted to them. Strips of heavy band iron support the




A Tool Room Furnace.

small electric motor (F) and the pressure blower (G). This furnace saves the toolmakers a tremendous amount of time that would otherwise be spent in running to the hardening room or in pumping up a gasoline blow torch.

### COMMENT ON PREVIOUS LETTERS

By Donald A. Hampson.

I NOTICE that a reader doubts if a revolving-head planer tool would work as well in practice as on paper. Some years ago, in building several special machines, there were required castings having a half round seat; some of 1 inch radius, some of 1½ inch radius and in lengths from 1½ to 2 feet. They were cast half round leaving the usual allowance for machining. Before planing, however, the circle was laid out on the ends of the castings and the inside filed down to this circle; filing at an angle of about 30 degrees with the cut to be taken, therefore, eliminating any danger of breaking out at the end of the cut, at the same time preserving the layout.

The point to be made in connection with the radius tool is that it was not used as a "stocking" tool but only as a finisher after the castings were planed down to within a shade of the filed

end with an ordinary tool. The revolving-head tool, when centered, scraped out 1-100 of an inch or so, which was well within its capacity. As a proof of the truth and smoothness of the finished work, the foreman of the machine shop at the plant having bought the lot, asked me later how those seats were "bored" out so nicely, he wanting the information for repair purposes.

**Chattering.**

Chattering is an effect, not a cause—the effect of insufficient support or the latter badly placed, loose parts in the lathe or of tools wrongly chosen or set. Work that is long in proportion to its diameter is notorious for chattering. On some rollers 8 ft. overall and 1 15-16 in. diameter, we used three steady rests between the ends; two might have been sufficient but as a single chatter mark meant the scrapping of the roll we deemed it wise to take every precaution. Some work needs only the slightest steadying influence and it is an old trick to hold the hand on the piece being turned. Again a piece of hardwood can be clamped on the cross slide at one side of the tool post so that its end prevents any "bouncing" of the work.

The average follow rest is of little value on slender work, for the weight of the piece sags it downward, and when starting a cut or "picking up" one, before the tool has forced the piece up into the V's, a cut deeper than the rest of the turned portion is sure to result, or if the lathe hand tries to avoid this and runs the tool out a little, a shoulder is formed that has to be filed off.

Putting in the centers without first cleaning them off and cleaning the hole out is a source of chatter. A loose headstock cap will do the same thing. Sometimes a wood wedge keeping the dog tight in the face plate slot will stop chattering, and if a lathe is old or its back gears badly worn, it is next to impossible to do a smooth job on a gear speed. In this connection, a workman could not run one of those "slim" jobs faster than the second gear speed without chatter. Another man took hold of the same job, shifted three speeds higher or to the first open speed, and the work was entirely free from marks.

A tool with a broad point ought not to be used on slender work—it cuts too much of a surface of metal and withal removes no more metal than a narrower pointed one. After a job has been chattered by such a tool it is hard to remove the tool marks. A narrow ended diamond point will generally do it, however, and the most effectual one is a tool that feeds in the opposite direction to the original broad nose, thus cutting across the furrows left by the other tool and not in them.

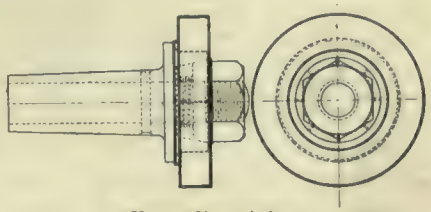
**Quick Replace Work.**

An instance of quick replace work is worth recounting — another will do no harm. One morning the motor driving the the main shop began to slow down. On going near to it, that unmistakeable odor was detected—the odor of a hot box. In some manner, the oil ring had jumped out of its slot and the babbitt in one box was ruined. It had melted, and in melting had taken a death grip on the shaft. The construction of the motor was such that the head frame had to be taken off to get the box out. To get the head off (and with it the box inside) it became necessary to use two 6 ft. bars to hitch the frame around the shaft slightly and another one to pry it off at the same time. Having got the box off, it had to be rebabbitted and bored out. Instead of sending it to another shop we decided to do the job ourselves, motor or no motor. Having foreseen all this when the babbitt was first discovered "seized" to the shaft we had the mandrel and molten babbitt all ready by the time the motor head was off. Likewise one of the idle men had prepared a lathe for boring the box, and as the helpers were mostly idle, they stood by readly to supply "mule power" to the lathe. This they did in relays, and so quickly, that in a little more than three hours we were running again. We couldn't have beaten this if the job had been sent to another shop.

## AN EXPANDING ARBOR.

By D. O. Barrett.

THE expanding arbor shown was designed for handling cast iron gear blanks, of which we have a great number to machine. The blanks are turned all over preparatory to having the teeth cut on a Farwell gear hobber. They are first caught in a universal three-



Expanding Arbor.

jaw chuck, bored and reamed to the proper size, and also faced down one side, which is also stepped; afterwards being put on the expanding arbor shown, turned to the proper diameter, and faced to thickness.

The arbor is held in the lathe spindle and driven merely by the fit of the taper shank. It was at first thought that under heavy cuts it would become loose, but no trouble was experienced from this source. The body is turned to the bore of the blank, with a shoulder at the back. It is also bored to take the stud, although this would not necessarily extend entirely through. The front is tapered out and split with eight slots, while fitted inside this and over the stud is a tapered washer, which may be pressed in by means of the nut on the stud. Back of this washer, which is hardened, is a heavy coil spring to force the same out when the nut is released. In order not to interfere with the tool when facing down the side, the body of the arbor does not come quite through the blank.

The heavy lines in the cut, of course, indicate the gear blank.

## SPLIT NUT GRIPS.

By T. R.

INSTANCES innumerable in which lathe work has to be performed on finished studs and bolts occur in all machine shops. Thus, bolts already screwed may require their heads reduced or faced or studs may have to be shortened or re-chased. To drive such a job in the lathe, the common practice is to screw two nuts on the thread and lock them; the lathe dog for driving the bolt or stud being clamped to the lock nuts, which thus protect the thread. However, this method is not always available. The threaded portion of the stud may be too short to take the two nuts, or the stud may be threaded larger than standard in order to fit some hole that has worn large through constant usage. In such cases other means must be devised, and the following method has proved thoroughly satisfactory.

Take a standard nut and with a hacksaw cut right through the centre of the hole. File the faces of the two halves smooth, and chamfer the edges of the thread to remove any burrs left by the saw. The two half nuts can then be clamped to the stud by the lathe dog. If the time taken to so clamp them be compared with the time taken to run on and lock two nuts, the advantages of the split nut method will be at once appreciated, especially where the studs or bolts are over size. Such split nuts are well nigh indispensable and should be kept readily accessible in every toolroom.

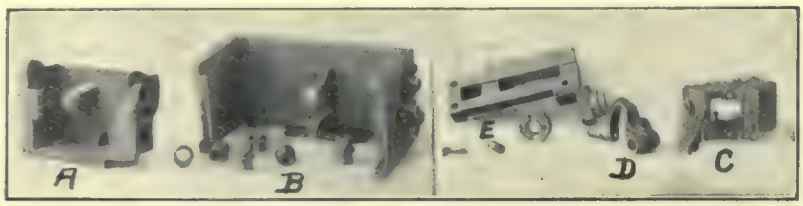
## JIGS FOR A QUICK CHANGE GEAR CASE.

By E. W. Tate.

ILLUSTRATED herewith are the jigs used in machining a quick change gear device. The gear case (A) contains seventeen holes excepting the lock pin holes, all of which are drilled through

the jig (B) at one setting, and (C) is the jig used to drill the lever (D).

The jig (E) is used to drill the bed to which the gear case is attached; thus avoiding the necessity of holding the case, which varies in weight from about




Jigs For Quick Change Gear Case.

fifty to two hundred pounds according to size. All parts of the cases are interchangeable; the same number of jigs being used to machine a large case as well as a small one.

## THE LOCOMOTIVE MAINTENANCE PROBLEM.

THE visitor at the locomotive shops of English railways may notice a practice which conduces greatly to economy and efficiency of locomotive repairs. He will see a number of complete boilers on hand for the different types of locomotives used by the road. For the most numerous types there may be five or six. When an engine comes in for heavy repairs, the old boiler is lifted off and a new one put in its place, so that the locomotive spends only a few hours in the shops, instead of the three or four weeks usual in this country.

### Advantages Accruing.

There are some very decided advantages to this practice in addition to keeping locomotives continuously in service. Figuring the value of a locomotive's time on the basis of its share of the entire earnings of the road—which we believe to be the correct method rather than using the mere interest on the investment—the loss of time in the shops amounts to more than the labor and materials used in repairing. On the other hand, the expense of carrying on hand extra boilers is only the interest on the investment, and this is more than compensated by other advantages. Work done in a hurry or under pressure of any kind is expensive and rarely thorough. By taking time to repair and to build boilers, the work in the shops can be equalized, a smaller force is kept steadily employed without overtime, inspection can be made thorough and everything runs smoothly. It is better for the men and better for the company. This is worth far more than the interest charge on extra boilers.

Any material reduction in the time which locomotives spend in the shops reduces the locomotive investment necessary to do the business of the road. In cases of emergency, such as the long-continued cold weather through which we have recently passed, or such a congestion of freight business as took place in 1907, the advantages of quick repair are enormous. The accumulation of crippled power at such times accentuates the congestion and it not infrequently leads to placing orders for large numbers of new locomotives beyond the normal requirements of the road.

The facility of making repairs also removes to a considerable extent the temptation to keep locomotives in service when they ought to be undergoing repairs. Locomotive failures and breakdowns are enormously expensive, although the cost of delay and detention of traffic cannot be figured with mathematical exactness. One railway system of which we know has a considerably higher cost of locomotive maintenance than some neighboring roads with similar conditions. It ascribes this to the policy of keeping its power in first-class condition at all times, thus ensuring regularity of service and decreased cost of operation, although at higher repair cost.

### Comparison of Locomotives.

European locomtives are better built. They cost more, but they stay out on the road doing their work, instead of spending 20 per cent. of their time in the shops. Boilers are built so as to be interchangeable; one can be taken off and another put in its place, without making new attachments and refitting. American locomotive boilers are not built with such accuracy. It is doubtful whether on any given lot of locomotives supposed to be exactly alike, an exchange of boilers could be quickly made. Such accuracy has not been deemed necessary, and, as it is supposed, at least, to cost more money it has not been aimed at. It is doubtful, therefore, whether with existing locomotives the English practice could be used. There is no doubt, however, that this lack of interchangeability is costing American railways an immense amount of money.

If there is to be no change in future practice, the number of types of locomotives will continue to increase, and each engine will be, as now, an individual machine instead of a member of an interchangeable class. This is not the only cause of growing cost of maintaining them, but it is an important one. The way toward decreased cost of maintenance and increased efficiency of operation leading to reduced transportation cost, lies in reducing the number of classes of locomotives on a road, and complete interchangeability within the class. The argument that this would hinder improvement through invention and design is fallacious; though it would prevent an enormous amount of expensive experimentation which never pans out.

We apprehend, also, that ultimately the cost of that accuracy which would be necessary to secure such interchangeability would not be as great as it is now claimed. It would not involve "building a locomotive like a watch"—although there are many reasons for believing that the road of truest economy lies in that direction. Orders for fifty or more locomotives of the same type and design are not infrequent in ordinary times. It would be interesting to learn just how much more would be charged for the necessary accuracy, and what would be the final economic results of a fair and sympathetic trial of the foreign practice we have mentioned. —The Railway and Engineering Review.

## PANAMA CANAL MACHINERY.

COL. Goethals, engineer in charge of construction of the Panama canal, in a report, states that over $15,000,000 worth of machinery has already been purchased in connection with the work. Some of the principal items are:—Steam shovels, 102; cars, 4,181; locomotives, 189; rock drills, 725; cranes, 79; dredges, 14; barges, 44. After the canal is placed in operation, many of the locomotives and cars will be continued in use, but the remainder of the equipment will be put up for sale.

Secretary of the Interior Fisher has suggested that much of the Panama canal machinery be transferred to Alaska for use in constructing a government railroad to the interior of that territory. It will be necessary for Congress to authorize the building of this road, however, before this plan can be considered.

## PREVENTION OF RAILWAY WRECKS.

MR. W. T. B. McDONALD, of Granby, P.Q., has invented an apparatus designed to prevent accidents such as that which occurred at Montreal, Windsor street station, a few years ago, when a passenger train dashed into the buffer, causing considerable loss of life. The arrangement is shown in the accompanying illustration. An inverted channel is placed on the rail for a distance of 100 feet; the section of rail and channel being seen in the left hand lower corner, fig. 1. To the inverted channel the special buffer is attached; thus the 100 feet of channel with the buffer on top is free to slide along the main track. As the train approaches the buffer it reaches the superimposed channel, and runs along this until it hits the buffer, when the force of the blow causes the whole upper track to slide on the lower, bringing the cars to rest with a minimum of damage.

It is claimed that a train with an engine and 10 coaches, like the G.T.R. International Limited, can be brought to rest in 40 feet when traveling at 40 miles an hour. A formal and successful test was made on Monday, July 22nd, when an engine and 10 cars bumped hard; it was of course, impossible to test under emergency conditions. The C.P.R. and the Grand Trunk are both considering the adoption of the device.

There is a piston rod with a semi-spherical end located at a proper height to be struck by the coupling. The blow forces the piston in, and compresses the air, thereby setting up a resistance. It also creates a vacuum at the other end, which assists the compression. Valves are arranged at both ends.

## STEAM V. ELECTRICITY FOR RAILWAY TRACTION.

JUDGING from the opinions of railway men so far expressed, it appears safe to say they are practically unanimous that for frequent uniform suburban services, electricity has already proved its superiority over steam for railway traction. Mr. E. B. Maitland, in a discussion at a graduates' meeting of the Institute of Mechanical Engineers, pointed out that "for services where there are many miles between successive stops and where a considerable time elapses between the passage of successive trains, the use of the steam locomotive permits of advantages which are unattainable with any electrical system of traction. It is obvious that for long lengths of track, both the first cost and maintenance charges for electricity will be considerably greater than those for steam; because not only are there the cost of the transmission lines, examination and repair of same, but also those of sub-stations and auxiliary machinery. Again, as there are far fewer trains than on the previously mentioned suburban services, the stand-by charges at power and sub-stations is proportionately increased.

The greatest point in favor of the steam locomotive with regard to ease of manipulation and traffic working, is, perhaps, its independence and freedom from sectional break-downs. It is also probable that before the electrification of our main lines could take place, the whole system of their commercial management would have to be changed, as they could only be run with anything like true economy by using district power stations, each supplying all the lines within a certain radius, so that what are at present separate railways would receive their current supply from the same nuclei. For short branch lines where there is light traffic, there seems little doubt that the self-contained steam coach has come to stay. For main lines, the whole question seems to be one of coal consumption; and with the modern steam locomotive, which the author believes is by no means incapable of further improvement, especially when superheating shall have been universally adopted with its attendant saving in coal and boiler maintenance, it will be very hard to prove its inferiority in this respect."

**Max E. Duncan**, who was recently connected with the American Car and Foundry Co., St. Louis, Mo., has associated himself with the Canadian Car and Foundry Co., Montreal.

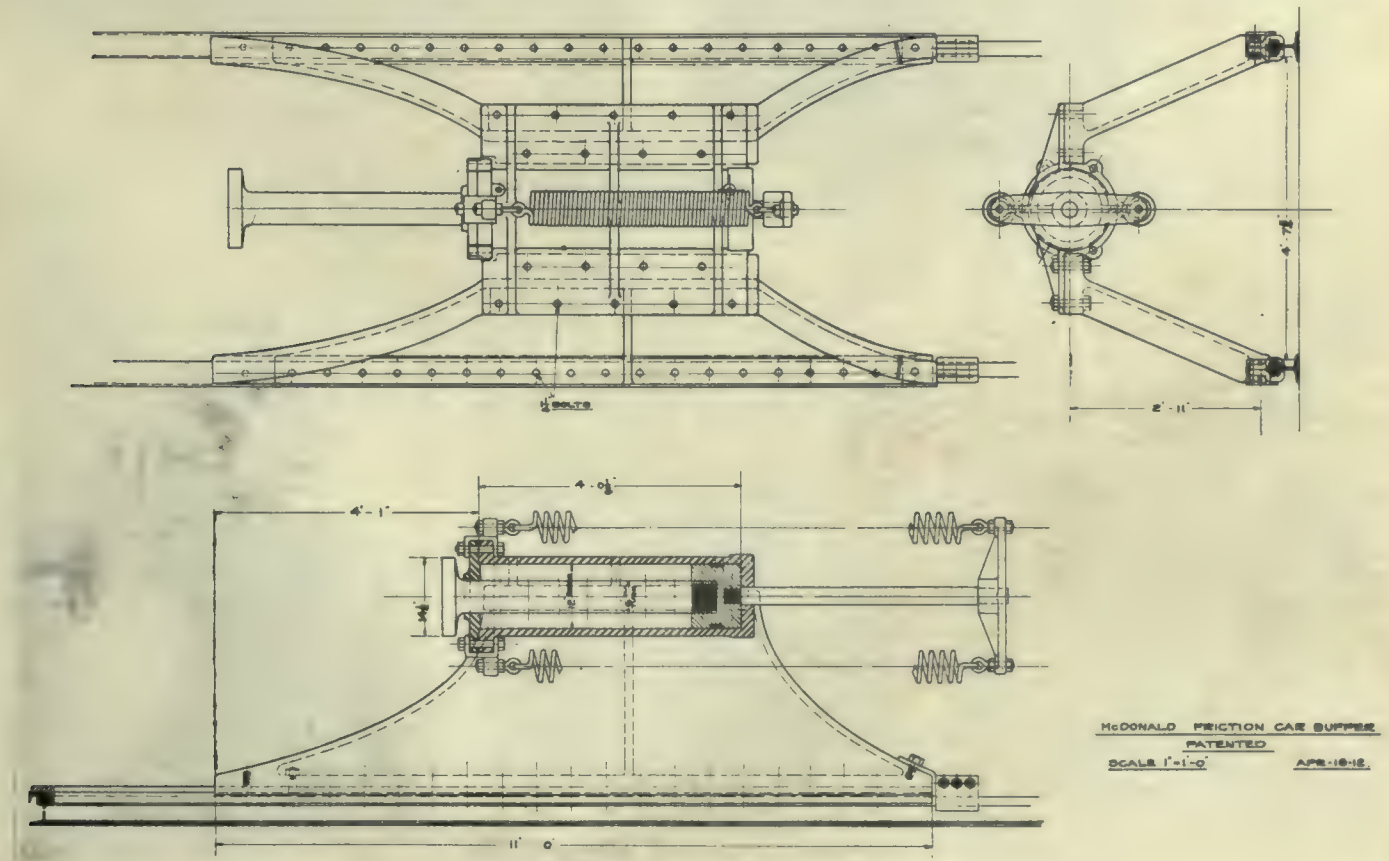


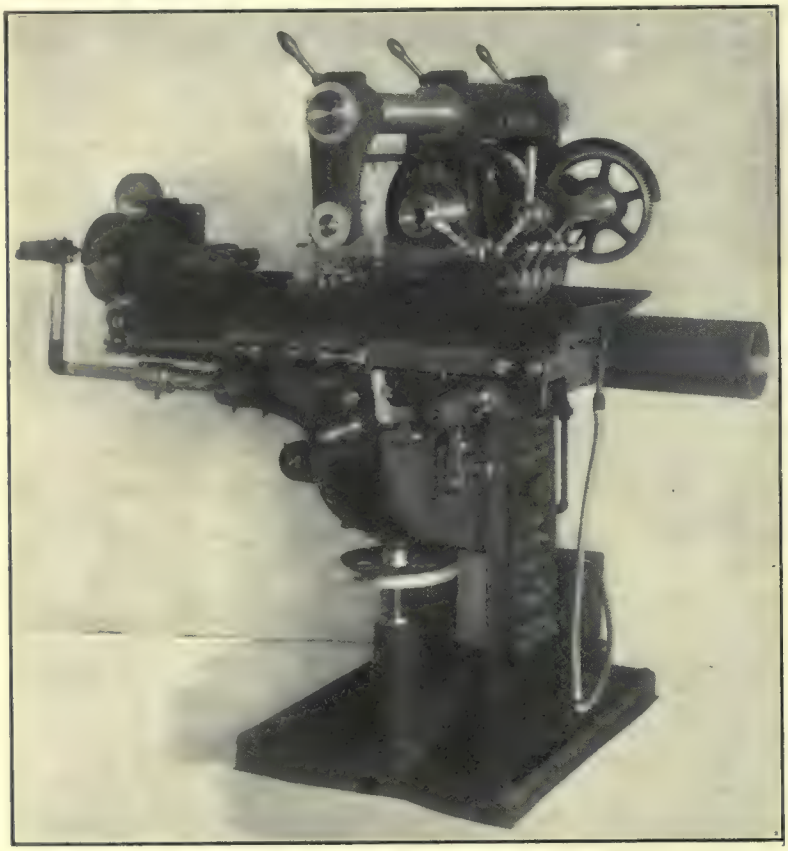

FIG. 1—PREVENTION OF RAILWAY WRECKS.

# DEVELOPMENTS IN MACHINERY

**A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.**

## AUTOMATIC INDEX MILLING MACHINE.

THE machine shown in the illustration is what is known to the trade as the No. 13½ Automatic Index Milling Machine. It is used for the automatic fluting of taps, reamers, the cutting of gears, ratchets, etc., and is adapted to the automatic and economical performance of repetition work. The modifications introduced comprise quick acting, work holding apparatus, automatic index, automatic feed with quick return by a long spring checked by an air cushion, and automatic stoppage of the machine when the work is completed.



AUTOMATIC INDEX MILLING MACHINE.

On finishing the cut, the machine is tripped by a dog shown to the left on the table, which releases the latch, allowing the worm to drop out of mesh with the worm gear. The table being now free from the power feed, rushes back to the other extreme of its travel by a spring enclosed in a tube at the rear of the table. This rapid motion is checked before the table reaches its fixed stop by the air cushion shown to the right of the machine. At the same moment that the dog trips the machine, the stop collar shown on the screw along the front of the table comes in contact with the bracket and trips the tilting table by means of the cam shaft, thus allowing the return of the work without the cutter dragging. As the table approaches the extreme return position, the right hand dog on the table strikes the stop plunger, bringing the worm back in mesh with the worm gear at the moment the table comes to rest. The bringing of the worm in mesh with a worm gear has been practised for the past fifty years for starting and stopping the feed of numerous machines.

When the table comes to rest, the right hand stop collar shown on the screw along the front of the table lifts the tilting table back to its work position and also lifts the index pawl so that the dial can index, and lets it fall back instantly. The machine is now ready for another cut, and this operation will keep up until the work is finished. The mechanism will trip again, and on indexing, the projecting pin on the index dial will push the corresponding sliding pin on the telescope bar—shown on the extreme left of the figure, and knock off the eye of the rope connecting with the spring on the countershaft, stopping further operation.

The machine will take 16 inches between centres, and a cut of 7½ inches long can be taken anywhere in this distance. The centres have a capacity for holding work on all four spindles up to 2 inches diam., and on the two outer spindles up to 4 inches diam. The machine weighs 2,200 lbs., and is an addition to the Automatic Index Milling Machine Line of the Garvin Machine Co., Spring and Varick Streets, New York City.

## MULTIPLE KEY SHAFT GRINDING MACHINE.

THE new multiple key shaft grinding machine, illustrated herewith, is designed to grind with a formed wheel simultaneously the side of two keys and radius between an integral multiple key shaft, or sliding gear shaft for an automobile transmission case. Liberal bearings, massive proportions where greatest strength is required, centralized location of operation, together with highly skilled labor in the construction of every detail, contribute to produce a machine of high efficiency, giving accuracy of finished product.

### Constructional Detail.

The vertical column is provided with two wide bearings, to which the grinding wheel head is gibbed. The column is substantially ribbed internally and is

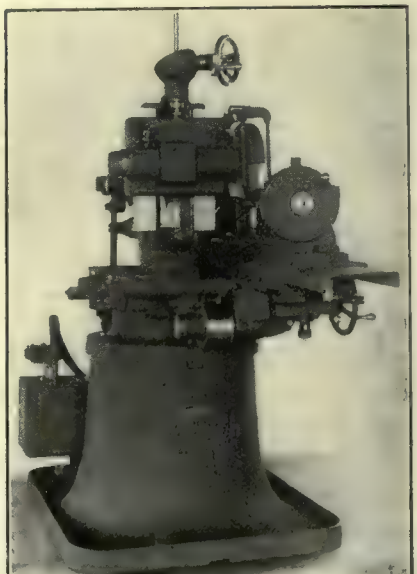


Fig 2.—Multiple Key Shaft Grinding Machine.

firmly bolted to top of base of machine, forming a massive unyielding unit. The grinding wheel head is of the most rigid construction. The wheel spindle is made of tool steel hardened and ground, and runs in large adjustable phosphor bronze bearings, thoroughly protected from grit. In the design, careful attention has been paid to the oiling system. The hand wheel which feeds the grinding wheel vertically is graduated to read to .00025 inch, and is provided with a stop for duplicating work. The thrust of the screw is taken by a ball thrust bearing.

The machine is provided with a semi-automatic indexing work-head, substantial in construction and firmly bolted to the table. The indexing mechanism consists of an index dial, a tooth ratchet wheel and an index plunger bolt, all of which are protected from water and grit. The index plunger bolt is automatically released by a slight backward movement of handle, and by a forward movement, the work is revolved and the plunger bolt engaged in next tapered notch. This mechanism is so designed that the dial cannot revolve backwards when free of the plunger, which insures positive action of indexing. The number of divisions on dial are determined by number of keys on shaft to be ground. The footstock furnished on this machine is very compact and rigid in construction. The centre carrier is flat, and set into the base at an angle, bringing the centre within ½ inch of top and ½ inch of inner side of footstock. This allows the grinding wheel to pass over or by the footstock, without disturbing setting of grinding wheel. The centre carrier is operated by a spring, controlled by a lever, shown at right hand end of footstock. The carrier may be locked firmly in position by handle shown at left hand end of footstock. All operating parts are thoroughly protected from water and grit.

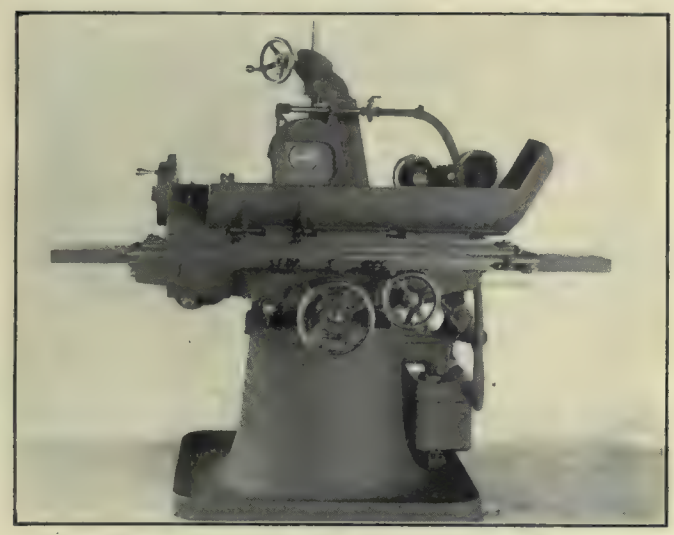


Fig. 1.—Multiple Key Shaft Grinding Machine.

**Wheel Trueing Device.**

The wheel trueing device is provided with three black diamonds, one for forming radius of wheel and operated by a short lever shown at end of fixture; the other two diamonds are for forming the sides of wheel and are operated simultaneously by long lever shown at end of fixture. The diamond for forming radius is carried by a steel spindle which revolves in a tapered bearing, and is provided with a very sensitive adjustment. The alignment or side forming diamonds are insured by adjustable tapered keys. It is intended that when this device is properly located back of the footstock, it will not be disturbed. When trueing the grinding wneel, the table is moved so as to bring centre of grinding wheel over centre of diamonds. The table is provided with a twin stop for locating correct position.

The master block for setting diamonds is clamped on top of wheel trueing device base, which is provided with a dovetail to insure alignment. The master block carries a hardened tool steel plug to which the diamonds are set. A shield is furnished to cover bearing on wheel trueing device when master block is not in use. A combination centering and rest base for centreing work with rapidity, and on slender work to act as support, is furnished. This fixture is clamped to table and is provided with a plunger, the top of which is formed to fit between two keys of the shaft to be ground. The plunger is actuated by a spring and controlled by a lever which has a cam cast integral and engages plunger. A slight turn of this lever to the left relieves plunger of shaft, or when used as a support for shaft, plunger may be clamped firmly in position by moving lever in opposite direction.

The table is controlled by adjustable dogs operating against the reversing lever which actuates the clutch of the load and fire type, or through conveniently located hand reversing lever which provides means for stopping the table at the end of its traverse automatically, by giving the lever a part of a turn at any time during the traverse of the table. All operating levers, handles and adjustments are within easy reach of the operator from the front of the machine. The water tank is separate, making it convenient for cleaning and the pump requires no priming or packing. The countershaft has self-oiling, self-lining bearings.

The Bath Grinder Co., Fitchburg, Mass., are makers of this machine.

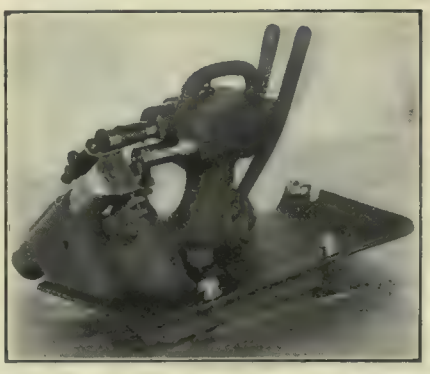


Fig. 4.—Wheel Trueing Device with Master Block in Place.

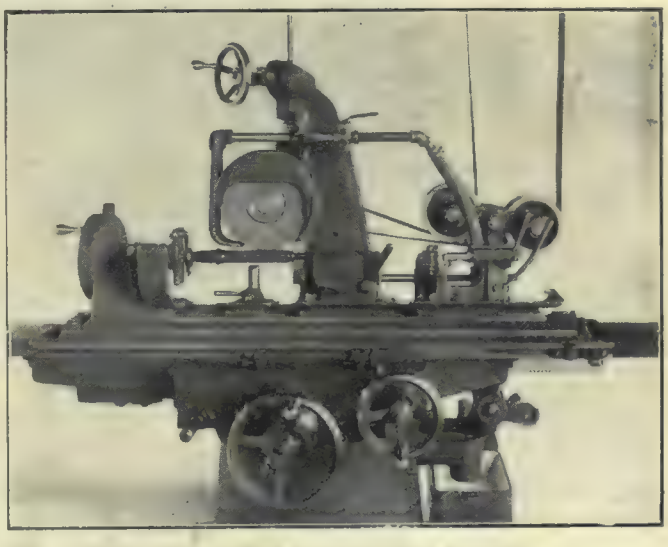


Fig. 3.—Multiple Key Shaft Grinding Machine.

## A LIGHT UNIVERSAL MILLER.

HEREWITH is illustrated a No. 2 light universal milling machine, especially adapted for tool room work or light manufacturing, which possesses several points of interest. As may be seen, the top of the column is spread out to take a special flanged support, which is bolted to the column seat, affording a wide bearing for the overhanging arm, and giving the latter stiffness and increasing the cutting capacity. This is a patented feature of the miller.

Vertical milling and slotting attach-

ments can be supplied with the machine; the former is seen at (A) Fig. 2, and the latter at (B). These attachments are not driven by the main spindle, but

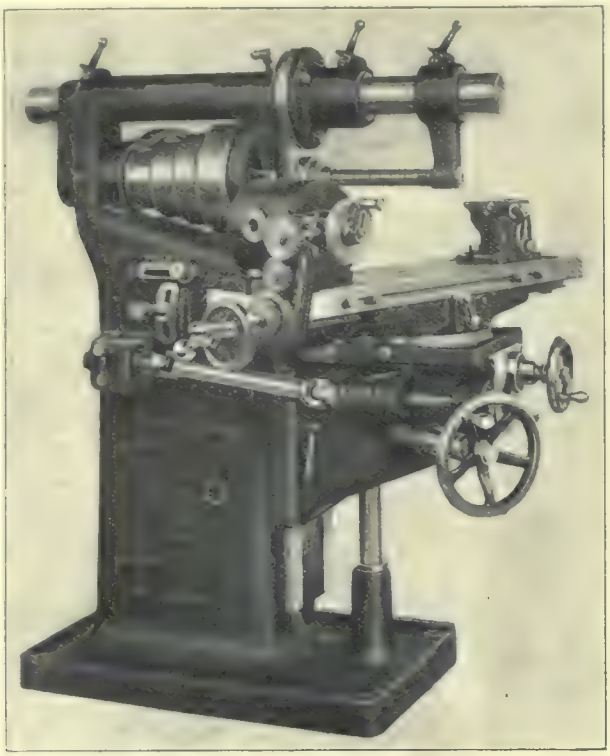


Fig. 1 Rockford Milling Machine.

on the contrary can be operated simultaneously with it. To use either, the overhanging arm and its flanged support are removed and the attachment substituted. The latter is driven by the special shaft shown at (C), Fig. 2; this shaft being geared to the back end of the main spindle, as seen at (D). When the main spindle only is in use, it is not always necessary to remove the attachment, since the latter can in many cases be swung round to clear the work. Either attachment can be rotated through a complete circle, the flange being graduated in degrees. The interesting manner of driving the attachments above indicated allows the full capacity of the machine to be utilized. The miller has automatic power feeds 25 x 7½ x 19 inches, while the main spindle has 16 speeds ranging from 22 to 309 R.P.M. There are 14 feed changes provided, all positively driven through gearing and capable of being operated and reversed while the machine is in motion.

The universal indexing head swings 10½ inches, and is fitted with an extra large worm wheel, 5⅝ inches diameter. The worm runs in an oil bath and can be easily disengaged from the worm wheel for quick indexing. This miller has been put upon the market by the Rockford Milling Machine Co., Rockford, Ill.

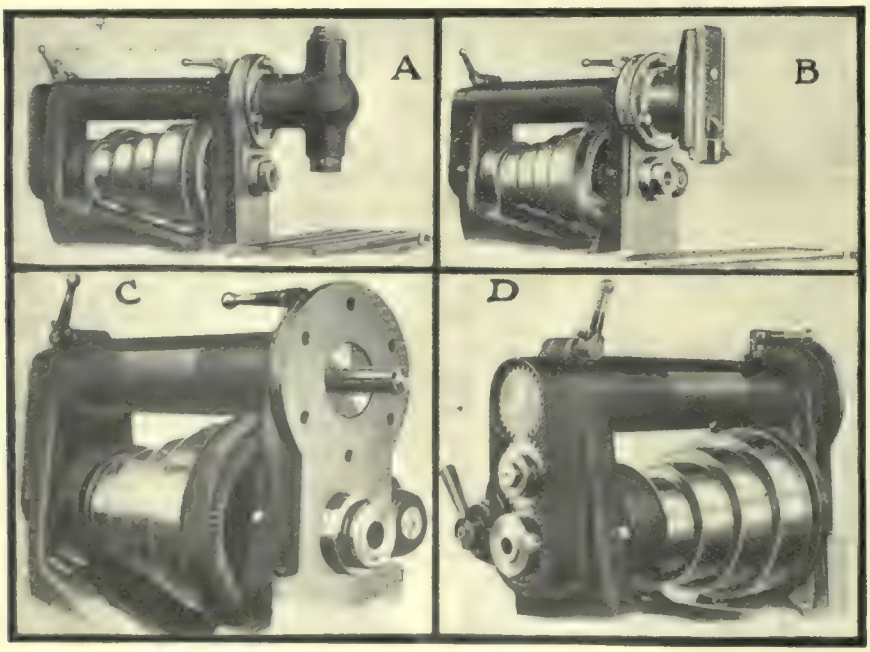
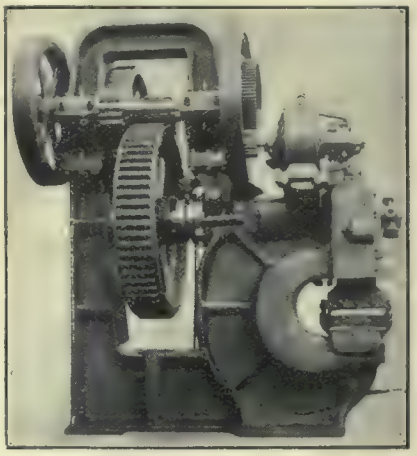



Fig. 2. Rockford Milling Machine.

## PUNCH AND SHEAR PRESS

ECONOMY of floor space, always an important item, is particularly so in a machine shop when it is desired to install additional tools. The accompanying illustration will indicate how this may be effected in the case of a motor-driven punch and shear press, made by the Cleveland Punch and Shear Works, Cleveland, Ohio. The arrangement of overhead gearing renders it possible to make a very compact unit, and one, thereby, economical of floor space. The machine complete with its motor weighs approximately 50,000 pounds, and is designed for heavy work, having sufficient capacity to shear twelve inch lengths of 1½ inch flat bars, and to punch a five-inch hole in 1½ inch plate. The various attachments such as those for angle shearing, bar shearing, and punching are interchangeable. The motor of 25 horsepower capacity at 230 volts, is of the well-known direct current, commutating pole type, specially adapted for this kind of work by the Westinghouse Electric Manufacturing Co.



Punch and Sheer Press.

**The Peterborough Engineering and Constructing Co.**, Peterborough, Ont., is about to be reorganized as a joint stock company. The plant is now being equipped with up-to-date machinery, and will have facilities for handling all kinds of repair work, more particularly the manufacturing of special machines of every description. Mr. P. H. F. Spies, formerly master mechanic with the Peterborough Shovel Co., is manager; Mr. F. S. Schneider, president, and Mr. G. F. Schneider, secretary-treasurer.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## SWEEPING OUT AN OVAL MOLD.

By J. H. Eastham.

THE rubbing plate for marble polishing purposes shown at Fig. 1 was required cast in halves, as indicated in sketch. Half an inch extra stock being

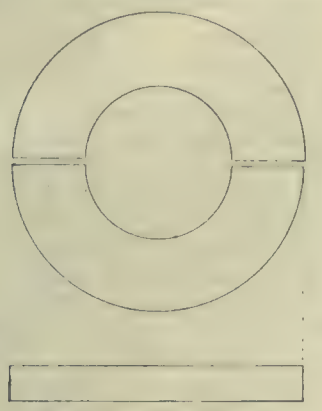


Fig. 1—Rubbing Plate.

ordered on each casting at the joints, and flat cores 3 inches thick being used to split the piece, an oval or elongated mold was of course compulsory.

As no pattern was available; the job being of the occasional variety, the spindle and sweep were resorted to, with the method of procedure as follows:—Two ordinary 2-inch spindles were clamped together exactly parallel at 4 inches centres; a special foot or centre being afterwards chilled round them. This casting, indicated at Fig. 2, was now bedded dead level in the foundry floor some six inches below the full depth of the mold, (A), Fig. 3. A spindle (B) was next mounted as shown, and the board or sweep (C) bolted to position; the straight or plain edge downward, so as to strike out a bed on which to ram-up the cope. The spindle was then removed, a layer of parting sand spread over the bed, and the cope rammed-up and hoisted away with runners and risers in their proper places.

Two half circles, the outside 1 inch wider and the inside 1½ inches narrower than full size of the plate, were now marked on the bed; the space between them being afterwards dug out 1 inch deeper than the finished mold. Following this operation the inside was lined up with facing sand; the sweep, with face or drag side downward, being then employed to strike out the bottom or drag impression, half the plate being struck from one hole in the centre piece and half from the one opposite, as shown at Fig. 4.

The space between the halves was now made good. A small section pattern was employed for the purpose and the gates cut. The mold was afterwards plumb-

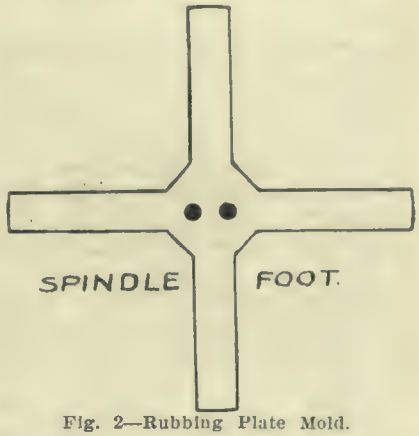



Fig. 2—Rubbing Plate Mold.

ago blackened, the splitting or division cores placed in position, and the cope lowered to place. Plan and sectional views of the finished mold, Figs. 5 and 6 show the types of gates and risers em-

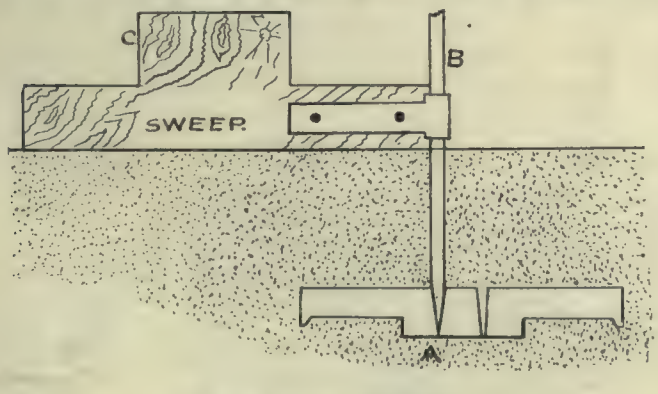



Fig. 3—Rubbing Plate Mold.

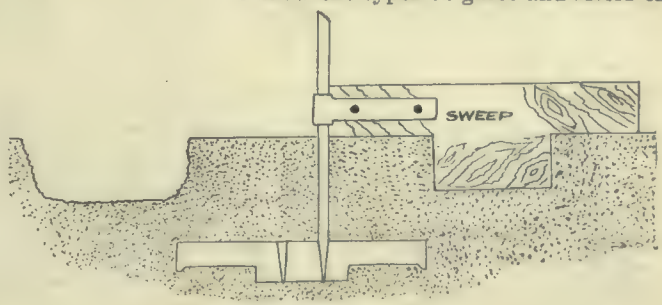



Fig. 4—Rubbing Plate Mold.

ployed; a quick flow of hot metal, low in phosphorus and moderately low in silicon with careful feeding through risers 5 inches diameter giving excellent results when the castings were machined.

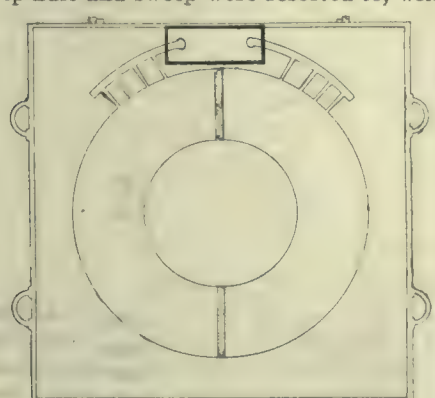


Fig. 5—Rubbing Plate Mold.

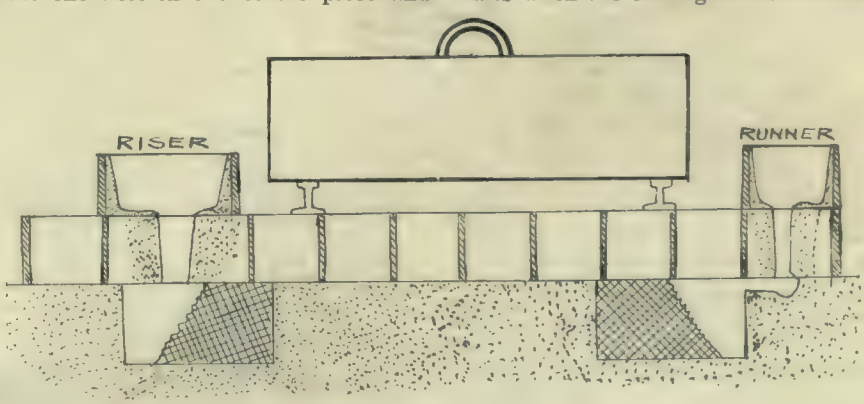



Fig. 6—Rubbing Plate Mold.

## LAYOUT AND PATTERNMAKING OF BEVEL GEARS.

D. O. Barrett, M.E.

IN the January issue of this publication, the writer presented a method of laying out and accurately forming the teeth of patterns for spur gears. The following discussion is along the same lines, but applied to bevel gears, and it is desired to show the layout and necessary calculations for determining the shape of the tooth in such a manner that it can be readily applied by any one without resorting to complicated calculations.

### Differential Gears of a Traction Engine.

The gears shown in Fig. 1 were encountered in the design of a traction engine; being the differential gears of same. There are four pinions set into the body of a large spur gear, and these transmit the entire power of the engine to the larger gears at either side. Each of these latter is rigidly connected to the driving pinion on that side, and the arrangement serves to allow one of the driving wheels to travel ahead of the other, as when turning a corner; yet insuring an equal amount of power being transmitted to each. All the gears are steel castings. The pitch diameter of the gear is calculated as for spur gears, having chosen the circular pitch and the number of teeth. However, the tooth contour does not conform to that for the same number of spur teeth.

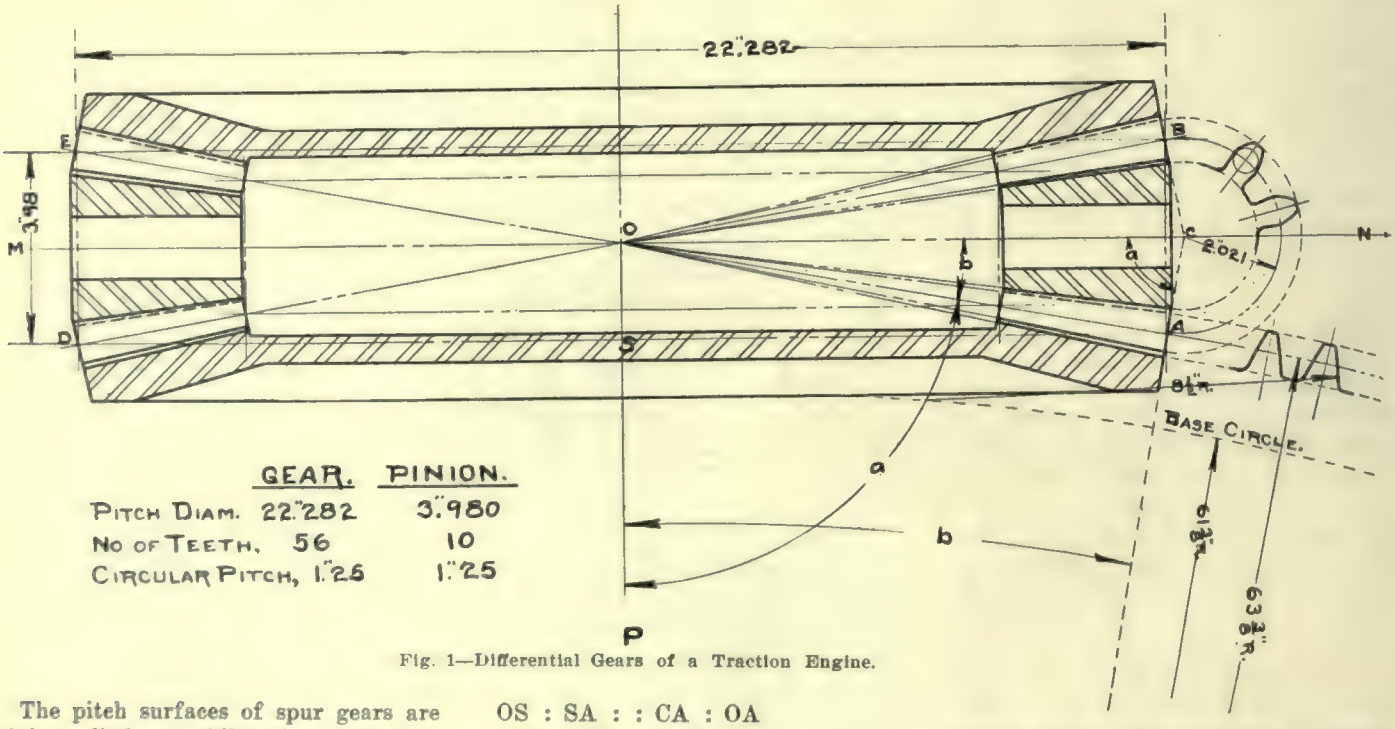



Fig. 1—Differential Gears of a Traction Engine.

The pitch surfaces of spur gears are plain cylinders, whilst the pitch surfaces of bevel gears are portions of cones which have a common vertex—the point of intersection of the shafts. The tooth shape is laid out on the surface of a cone whose slant side is perpendicular to the slant side of the pitch cone. The angles (a) and (b) are called the centre angles, or angles of the pitch cones of the gear and pinion respectively. These two angles are complements of each other, that is, their sum is equal to 90 degrees. The backs of the teeth are laid out perpendicular to the pitch or centre line and continued until they intersect the centre lines of the gears as (MN) at (C), while the intersection of the centre line (OP) comes without the limits of the drawing. Now, this distance from the point of intersection of the pitch line as at (A) to the respective centre line is the determining radius for which the tooth shapes are calculated. Fig. 2 shows the complete layout with the necessary dimensions. The distances (OS) and (SA) are one half the pitch diameters. (OA) is the pitch line or intersecting line of the pitch cones. (CAP) is drawn perpendicular to this, and intersects the centre lines at (C) and (P). It is necessary to determine the lengths (CA) and (AP).

The distance (OA) is found by the solution of the right angle triangle.

$OA = \sqrt{(OS)^2 + (SA)^2} =$

$\sqrt{(1.99)^2 + (11.141)^2} = 11.371$ in.

Now the triangles (OSA), (ASP) and (CAO) are all similar right angle triangles, and consequently the sides are proportional.

We may, therefore, write:

OS : OA : : AS : AP

OS : SA : : CA : OA

$$\text{or } \frac{OS}{OA} = \frac{AS}{AP} \text{ and } \frac{OS}{SA} = \frac{CA}{OA}$$

$$\text{or } AP = \frac{AS \times OA}{OS} \text{ and } CA = \frac{OS \times OA}{SA}.$$

$$\text{Substituting, } AP = \frac{11.141 \times 11.317}{1.99}$$

$$= 63.358 \text{ inches, and } CA = \frac{1.99 \times 11.317}{11.141}$$

= 2.021 inches.

The distances 2.021 and 63.358 are the radii of pitch circles that determine the number of teeth from which we obtain the desired shape. The teeth from now on are laid out as simple spur teeth, and the number corresponding to the radius of 63.358 will be

$$\frac{2 \times 63.358 \times 3.1416}{1.25} = 318.$$

Turning to the table in the January issue, we find the constant for 318 teeth to be 6.88, which multiplied by the circular pitch gives $6.88 \times 1\frac{1}{4} = 8.55$, say $8\frac{1}{2}$ inches. The base circle will be $63\frac{3}{8}$ (which is sufficiently close) times $0.968 = 61\frac{3}{8}$, approximately. The tooth is laid out at the side of the gear, all the other dimensions being obtained as previously shown. Of course, the centre (P) may be found graphically by extending the perpendicular (AP) until it intersects the centre line (OP), but the calculations may be performed by any one who is familiar with square root, and if not, tables giving square roots are readily obtainable.

Proceeding in the same way for the pinion, we find the radius to be 2.021, which gives slightly over 10 teeth. The nearest whole number must, of course, be used, and the calculations made for this number. We now have the actual shape of the teeth at the outer end, and it only remains to produce them in the pattern. Of course, these cannot be

cut by a formed cutter as with the spur gears, on account of the shape continually changing; the sides gradually converging to the centre (O). It will be noticed that the larger teeth are drawn with a single curve.

A block, preferably of maple (Fig. 3), is now cut out as at (JA), the length

Fig. 5—Layout and Patternmaking of Bevel Gears.

of the tooth to be formed. The large end of the tooth (A) should have the shape as laid out in Fig. 1. However, it would be rather inconvenient to lay this out here, and, better than this, a shape can be laid out on each end of the block, so that the desired form shall be produced at (A). To do this, lay out a diagram as in Fig. 4, where (OA)

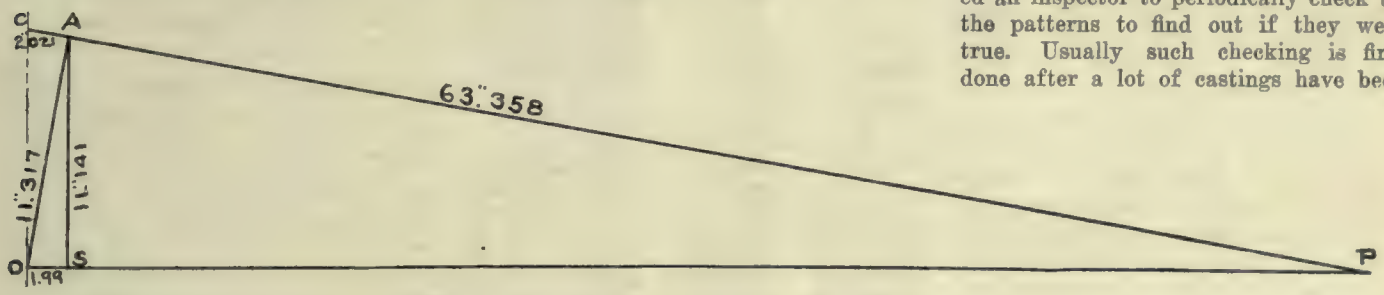



Fig. 2—Layout and Patternmaking of Bevel Gears.

corresponds to the distance (OA) of Fig. 3, (OF) to (FA) and (OG) to (AG). Join (O) to (G) and (F). These dimensions need not be the exact dimensions of Fig. 3, but may be some fraction of same, as long as all remain in the proper proportion. Take any dimension on the actual tooth profile and lay out along the line (OA), as (OX). Draw a line through (X) parallel to (FG); then the distance (XZ) is the length to be laid out on the end (G), and (XY) the length to be laid out on the end (F).

Correspondingly, enough distances may be taken so that the shapes can be accurately laid out at each end when the block may be readily tapered from (G) to (F), so that all the lines drawn along the sides would converge at (O). The teeth are cut to the proper length and inserted in the block, being held by the two screws at the bottom. It is best to rough them all out by hand to somewhere near the proper shape before finally finishing.

A wooden cylinder is now turned up as in Fig. 5; about the same length as the formed block for holding the teeth. In the centre a portion is turned slightly smaller so that when a strip of sandpaper is glued to it the surface of the paper will come even with the ends of the cylinder. The length of the paper is made just a little longer than the teeth. The rough teeth are now inserted in the holder, and they can be read-

Fig. 3—Layout and Patternmaking of Bevel Gears.

ily sandpapered to the exact shape, as the ends of the cylinder will bear against the ends of the formed block and prevent the teeth being cut lower than the block. If the teeth are worked out to nearly the desired shape, the process of sandpapering requires but a few minutes. Of course, it is not possible to have the fillet at the bottom part of the tooth by setting same into the body of the gear, as was done with the spur tooth, because the sandpaper cylinder will not get into the smaller circle.

The teeth can be very rapidly formed by this method; the most accurate part of the work being the shaping of the block in which the teeth are held, be-

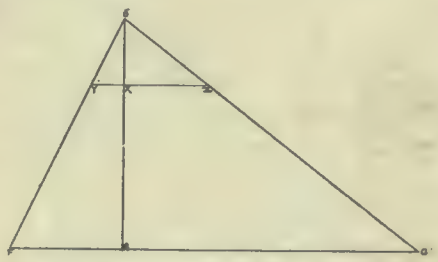



Fig. 4—Layout and Patternmaking of Bevel Gears.

cause the teeth will be reproductions of this shape. To get the proper angle at which to turn the body of the gear where the teeth are held, a side view of the pattern should be drawn, as in Fig. 1.

## PATTERNS FOR THE FOUNDRY.

IN an address before the Superintendents' and Foremen's Club at Oakley, Cincinnati, Ohio, Mr. H. M. Ramp, superintendent of the Modern Foundry Co., called attention to the difficulties the foundryman has to meet because of the fact that patterns are poorly made or in poor condition. In the course of his address he said that many concerns have inspectors who check up every piece of work done in the factory; some have inspectors who check up every gage and templet at stated periods to discover errors and prevent mistakes; but he knew of no concern that employed an inspector to periodically check up the patterns to find out if they were true. Usually such checking is first done after a lot of castings have been rejected, and only then is the pattern found to be at fault.

There seems to be a tendency to-day to save on pattern cost, although a great deal of money is spent for improved machinery in the machine shop to improve the quality and cheapen the cost of the finished product. The average patterns in the average foundry to-day are not made as well as they were ten years ago, and still there is a reason why the foundry ought to be supplied with better patterns than formerly. The trend of the times is to reduce the skill of the workers by putting more dependence on improved machinery; hence the molders of to-day are not as skilled as they were years ago, and, for that reason, better patterns rather than poorer ought to be the rule.

Mr. Ramp also called attention to the lack of understanding of the requirements of the foundry on the part of many machine designers. The castings designed may be perfectly fitted for the purpose for which they are made, but the design is such that the molder cannot make a perfect casting on account of the excessive strains produced by the unequal proportions of the different

parts, and it is impossible to prevent these castings from cracking or warping. It is easy enough to say that no more metal is required at this or that point; it may be very creditable to be able to design a machine with a maximum of utility and a minimum of weight, but, nevertheless, there are unalterable laws in the shrinkage or contraction of cast iron that the designer cannot be permitted to overlook. Many castings are designed with a view to saving metal, which, as a matter of fact, will have a higher ultimate cost than if no specific effort to save metal had been made. The extra labor cost in the foundry in such cases outweighs the saving in the cost of the metal.

## CRUCIBLE STEEL FURNACES.

THE increased life of furnaces used for melting crucible steel, due to the careful supervision which is now being given this class of work, has been again demonstrated by the record of a 24-pot furnace in operation at the works of the Colonial Steel Co., Monaca, Pa. This furnace was in continuous operation from January 19, 1910, until March 20, 1912,—a period of twenty-six months and ten days, during all of which time the gas was on and the fire kept in the furnace. Steel was melted every day with the exception of Sundays, fifty-two Saturdays and eight days in the month of July, 1911; making in this period 3513 heats. The total weight of steel melted was 9,274,320 lb., of which 924,000 lb. was high speed steel, the remainder consisting of carbon tool steel and special alloy steels, such as chrome nickel, chrome tungsten and 30 per cent. nickel steel. The total cost for repairs was about $20.

## BELT INFLUENCE ON MOTOR OUTPUT.

By Geo. P. Pearce.

WE had supplied a double disk mill to a large grain company whom we will call the Smith Flour and Grain Co.; also two 10 horsepower motors to drive it. Our customer said they could install the outfit and that they would furnish the two 8-in. belts for driving. They stated the number of bags of meal required per hour and did not wish us to send larger motors than necessary, as the central station charged a certain minimum per month based upon horsepower installed. We had found by experience that 10 h.p. on each side would just exceed the amount they asked and, therefore sent this size motors.

It was not long after the machinery had been shipped that we received quite a sharp letter from the Smith Flour and Grain Co., saying that they had installed the machinery exactly as shown on the blue prints, but they were unable to grind even half as much as we had claimed and that the outfit was useless to them in this state. They got electricians up from the central station, who, after a very careful test, found that the motors were o.k., but recommended that the two 10 h.p. units be replaced by two of 20 h.p. The Smith Flour and Grain Co., were of opinion that we did not know much about our own business, by installing a total of 20 h.p., when the actual requirements were at least a total of 40 h.p. The writer was bidden go and investigate the trouble. Upon arrival, I first made a trip to the central station and asked to see the records of the test. The electrical engineer, there, was very sarcastic in his remarks about theoretical calculations being all right sometimes, but when it came to grinding machinery there had to be plenty of power, and as the motors installed would never be of any use, the quicker we put in two of 20 h.p. each, the better it would be all round. The test record certainly appeared to uphold his statement.

I then went on to the mill and was received with the cheerful information that it was up to me or the firm to make that drive right at no cost to them. I examined the mill equipment and motors and found the installation O.K. Everything was in line and level. It was rather a dark place. I started the mill, and while it started up all right, I noticed it acted sluggishly, so I shut down and went into the basement to see the motors. The wires were amply large and all connections were tight. I decided, however, to try each part separately to find out the source of the extra friction, and pulled off a few of the boards that enclosed the belts. This had been done to prevent the windage of the high speed belts from carrying dust from one floor to another. I reached in to take hold of the belt, and in doing so got a surprise, for it seemed to me that the belt was ½ inch or more in thickness. I secured a light, and there, through the hole, saw the trouble —a heavy 8 in., three-ply stiff leather belt. I asked the man who was holding the light, why on earth they bought such a heavy belt to go over 10 in. and 12 in. pulleys, running nearly 5,000 feet per minute? He said it was part of the old 16-in. engine belt that they had used before changing over to electric drive, and that they had sawn it in two to make 8 in. widths out of it.

I went to the office and told the manager that the belts were the cause of all the trouble, and that if they would get suitable belts I would prove to them that the outfit would turn out the amount guaranteed. He only laughed and said that changing belts was not going to make all that difference; that the belts installed were of the highest grade and had cost a pile of money when new. Further, they had not been used much, and had given splendid service when on the engine. It was no use calling his attention to the fact that the smallest pulley on which it formerly ran was 48 in. diameter, while that in the present instance was only 10 in. I could get no satisfaction except that if I wanted to try any "stunts" before ordering the bigger motors I could go ahead at my own expense, and that I had better hustle, as they wanted cracked corn and meal at once. I was also informed that if they had to wait very much longer he would rip it all out and I could ship it back, there being a competitor with a complete outfit ready to instal at the word "go," with a guarantee on penalty to get results. I telephoned a big belt concern in the next city to send me down by express an 8 in. light double rawhide belt long enough for both machines.

The belting came in the afternoon, and I had both on in an hour, nicely laced with wire lacing. We started up and the mill rose to full speed in ten seconds. I started grinding right away, and for three hours I ground at a good 10 per cent. in excess of the guaranteed rate; at the end of which time, the motors were not more than warm. The manager had gone home without making any comment; I, however, got the miller to sign a report to the effect that he had seen the mill doing 10 per cent. better than the guarantee without sign of overload on the motors. There was no further trouble from that day to this, nevertheless, the manager put up a strong kick before he paid for the new belts, adding that he hadn't much opinion of a machine that required a special kind of belt before it would work. The saving every month on his minimum rate, by having these small motors, did not appeal to him; but, then, some people will kick anyway.

## ELECTRIC LOCOMOTIVES.

ONE great advantage of electric locomotives is the way in which, provided the line voltage is maintained, they can be relied on to develop their full power at any time, not having to depend on the state of the boiler, the skill of the fireman or the quality of fuel available. From the point of view of adhesion or grip of the driving wheels on the track rails, the motor has an advantage over the steam engine in that the torque exerted is quite uniform; for this reason there is not the same ten-

dency to slip when starting under load. There is said to be as much as 20 per cent. difference between the adhesive properties of the two kinds of engine. This effect is counterbalanced in practice owing to the steam locomotive being for other reasons made heavier than an electric locomotive of the same draw-bar pull, but only at the cost of the power necessary to move the additional weight.

The electric locomotive can be designed to have exactly the correct weight required to give sufficient adhesion at its rated draw-bar pull. It can, moreover, in the face of any abnormal demand, take advantage of the greater adhesion to be obtained by sanding the track rails, as it is able to draw power from the line and to exert a torque at its driving wheels up to the utmost limit of adhesion. This the steam locomotive cannot do, because it has no reserve power to draw upon.

## ANALYSIS OF ACCIDENTS IN A MACHINE SHOP.*

By Luther D. Burlingame,
Providence, R.I.

IN making a study of safety methods and safety devices, an analysis of the accidents that have occurred in one of our large machine shops may be of service for still further protecting the workmen when engaged in their various lines of employment.

A careful record of all accidents in the works of the Brown & Sharpe Manufacturing Co., has been kept during the last seven years and a study made for the purpose of ascertaining where danger is greatest, also what accidents are preventable and how best to avoid them. It may be said that in this factory extra care has been taken for many years to guard against accident, and the management has never hesitated to spend money for that purpose when convinced that it would bring about safer conditions. During the last year an additional effort has been made to profit by past experience both at our own works and by the experience of others, and still further to tune up the safety equipment and spirit of the organization in order that accidents might be reduced to a minimum.

### Method of Procedure Adopted.

When this additional work was undertaken, about a year ago, an analysis of all accidents which occurred during the previous six years was made along three lines: (a)—The percentage of accidents under each of 18 headings from different causes; (b)—the percentage by departments of the shop, divided into more than 30 groups; (c)—the seriousness of the injury and the resulting length of disability from work. Following this, a similar record, (d)—is being kept each year showing what kinds of accidents are increasing and what kinds are being decreased by the further safety methods employed, also which departments are reducing their accidents and which are growing worse.

### Classification of Accidents.

The different kinds accidents were classified as follows, the percentages given being for the six years preceding the date of the investigation—1905 to 1910 inclusive:—

| | Total Accidents | % |
|---|---|---|
| Caught in machinery | 78 | 7 |
| Caught or struck by belt | 23 | 2 |
| Set screw or other projection | 29 | 2.6 |
| Falling on or striking workman | 226 | 20.1 |
| Workman falling or strain lifting | 75 | 6.7 |
| Machinery starting unexpectedly | 8 | 0.7 |
| Chain or rope slipping or breaking | 10 | 1.0 |
| Punch press, rolls, or shears | 20 | 2 |
| Cutters and metal saws | 94 | 8.5 |
| Handling work or chips—eyes. | 126 | 11.2 |
| Woodworking machinery | 47 | 4.2 |
| Burns, including electricity | 79 | 7.0 |
| Cuts with sharp instruments | 20 | 2 |
| Jams and hammer blows | 71 | 6.3 |
| Caught in tool and work (not cutters) | 176 | 15.7 |
| Elevator | 4 | 0.5 |
| Fooling | 13 | 1.2 |
| Litter or dark places | 15 | 1.3 |

These accidents naturally divide into two groups: (1)—Those caused by machinery either (a) by being caught in the gearing, belting or other parts of the machinery, or (b) through being injured by the cutter or other tool or caught between the tool and the work; (2)—Those caused by falling, jams, burns, cuts, etc. The first group includes 42.7 per cent. of the accidents occuring during the six years, divided as follows: Group (a) 12.3 per cent; group (b) 30.4 per cent, leaving 57.3 per cent as the proportion of accidents occurring under the second group.

### Machinery Guard Features.

From the above analysis it will be seen that if complete guards were provided to prevent every accident due to being caught in gearing, on set screws, or anywhere in the mechanism of machinery, it could at most only reduce the accidents 12.3 per cent. Several recent occurrences show unexpected accidents. A workman hearing a rattling in the knee of a milling machine he was operating, reached his hand underneath to see if the cause were due to a collar which he thought might have become loose, and stuck his finger into the running gearing.

Another case was that of a workman who reached for a can of oil which he had left on a ledge of the machine. In lifting it up he caught a finger in the pump gears back of the guard. Both of these accidents occurred on machines considered sufficiently guarded, and to experienced workmen, yet they indicate that to have complete safety it may be necessary to enclose all gearing entirely, whether or not it is exposed.

A way of preventing accidents through being caught by set screws or other projections, is to insist on the wearing of short-sleeved jumpers and avoid loose clothing, hanging neckties, etc. One of the apprentices at the Brown & Sharpe Manufacturing Co., works was injured recently by having the pocket of his jumper catch on the set screws of the revolving dog while he was filing. All of the boys running machines at this plant are obliged to wear short-sleeved jumpers and the men are advised to do likewise. Seventeen of the accidents reported were due to being caught by the sleeve of the jumpers. The company is now experimenting with various forms of safety dogs, none with projecting set screws having been added to the equipment during the last year. The plan of changing the regular dogs, for headless screws adjusted with a socket wrench, is also being tried experimentally.

### Guards Sometimes Undesirable.

The accidents in group (b) are more frequent and more difficult to guard against. It is practically impossible in many cases to do guarding at the point of cutting, and if guarding is attempted it may introduce dangers greater than those sought to be avoided. It is, however, possible to insist that the fingers shall never be used to wipe off chips, etc., from a running cutter. Out of the 94 accidents from cutters reported, 30 were caused by being caught when wiping off chips with the fingers.

In the use of punch presses, 20 accidents had occured in the period investigated, so this was one of the first matters to be considered. The means adopted for guarding against these accidents were novel, as far as the author is aware, and have proved entirely successful both in avoiding accidents and in preventing an appreciable increase in cost of doing the work. A rule was made that the fingers and hands must never be put between the punch and die. Tweezers and pliers were furnished for handling the work, the points being shaped in some cases to suit particular jobs. The only accidents since have been to the points of the tweezers and pliers. Chutes have also been used to slide the work into position, a stick being used to remove it after the operation. For some work which it was thought could not be handled by the above means, a swinging fixture was designed so that the job can be put in place away from under the punch and then swung into position for the operation.

*Presented before the April, 1912, meeting of the Providence Association of Mechanical Engineers.

The 47 accidents from woodworking machinery were largely cuts from circulars saws, but included eight where the block of wood was thrown back when slitting, two of the cases being fatal, the only fatal accidents in the works during this period. The men are now required to wear a heavily padded apron when using a slitting saw, and this has, it is believed, saved the lives of several workmen. The use of a "spreader" when properly installed helps to prevent such accidents by keeping the cut from closing in back of the saw. Another prolific source of accidents which, while not serious perhaps, are painful, is in being cut by revolving grinding wheels, especially when doing internal grinding and trying the plug in the hole without running the wheel back a sufficient distance. Twenty-eight of the accidents were from this cause. A shield has been designed which automatically swings up in front of the wheel so as to protect the hand if the plug should slip.

### Accidents Due to Carelessness.

Under the second group, falling, jams, burns, cuts, etc., a large proportion of the accidents are entirely within the control of the operator, either the one hurt or a fellow workman, and the remedy is largely to be found by employing careful methods. In this, however, the foreman can exercise a large influence for safety. Some specific remedies can also be applied. It was found that 37 cases of burned feet in the foundry had resulted from wearing laced or low shoes. A rule was made that Congress or other high shoes without lacing should be worn, and a supply of such shoes is kept and sold to the foundryman at about cost. This has nearly remedied the trouble. There remains, however, the liability of the iron spattering into the tops of the shoes and burning the legs when the pants are ragged. A study is being made of the possibility of using pants made of non-burnable material. About one-fourth of all the accidents are caused by weights falling on the workman and jamming or cutting either the hands or the feet, and the workman himself slipping and falling. The remedy here is to use care that safe methods are employed and that men do not take chances. Classified with these are 13 accidents traceable to "fooling," some occurring outside of working hours.

### Accident Classification.

In considering the classification by departments and kinds of work, it was found that, for the period of six years, the average number of accidents was greatest in the following departments, the percentage of employes injured each year being as stated:

(a)—Grinding department, 13.8 per cent.; caused largely by cuts from grinding wheels. This has been much reduced during the past year, so that this department now ranks eighth instead of first in order of accidents.

(b)—Laborers, 10.6 per cent.; largely from injury by falling objects, jams, strains in lifting and the workman falling.

(c)—Carpenters, 10 per cent.; a large proportion of the injuries being due to woodworking machinery.

(d)—Foundry, 9.5 per cent.; due mainly to burns, also to falls and falling objects.

Then follow the various machine departments from 7.6 per cent. down to 2.2 per cent., and ending with the inspection department, the offices and the drafting department with the percentage coming down to 0. Only four elevator accidents, and these slight, occurred during the six years, a very good showing with more than a dozen elevators in constant operation.

**THE ADVERTISING SECTION**

**Intimacy with the advertisements appearing each month in the columns of this journal ensures easy location of a manufacturer and his product by the progressive and up-to-date user of machine tools and kindred equipment. Look the pages over, and you will strengthen and widen acquaintance with the masters of your profession.**

### Injury Classification.

In the classification by seriousness of injury and length of disability of 1,124 accidents occurring during the period of six years covered, 382 resulted in no disability, that is, no absence from work. In 457 cases there was less than one week's absence from work. Of the remaining 285 cases, 132 resulted in between one and two week's absence; 74 in two to four weeks' absence; 51 in one to three months' absence; five in three to six months' absence; and five in over six months' absence. In addition, eight were hurt so as to cause the loss of an eye, a foot or permanent injury, two dying from the effects of their injuries. Ten men left, and no record was kept of the duration of their disability. These statistics form a good basis for future investigations looking towards a still further accident reduction.

In 1911, with an average of 4,050 employes, there were 243 accidents, or about 6 per cent. of the workmen were hurt, sufficiently to report; this on a basis of reporting slight accidents as well as those of a more serious character. Some of the added measures for safety had been in operation during part of the year, so that the gain from 6½ per cent., the record of the previous year, to 6 per cent. for 1911, indicated a gain due to such further safeguarding. A like gain was also shown in the reduced number of serious accidents included in last year's list. There were no fatal accidents, no loss of eye or limb, and more than 70 per cent. of the reported accidents resulted either in no disability or in less than one week's loss of time. In some few departments, where accidents increased during the past year, special steps are being taken to ascertain the cause and to avoid a repetition. Each accident is studied to learn the lesson it teaches as to further methods of safety. It is hoped by such means to reduce the accident list to a minimum for the benefit of both workmen and employers.

## FOUNDRYMEN'S CONVENTION AT BUFFALO.

THE American Foundrymen's Association Convention to be held in Buffalo on September 24, 25 and 26 of this year promises to be at least equally as successful as its predecessors. Following the practice of former years, the Foundry Machine Exhibition Co., will have on display and in operation from September 23 to 27th inclusive, an up-to-date assortment of machines, tools, appliances and accessories relative to foundry and allied trades practice. The American Institute of Metals and the American Foundry Foremen's Association will also meet in Buffalo during the same week, hotel headquarters arrangements having already been determined upon by the various sections. Secretary Richard Moldenke, Watchung, N.J., has prepared a circular of particulars of special reduced fares obtainable on the various railroad systems and will gladly give all information. Canadian Foundrymen have a great opportunity this year of getting into intimate touch with the latest developments in their chosen profession, and every encouragemnt should be given employes of our numerous foundry plants to spend a day or two in Buffalo. Our September issue will contain full details of the convention programe together with list of exhibitors, etc.

**The Dominion Metal .Co.**, of Sherbrooke, P.Q., have chosen rather a novel method of keeping their name before users of babbitt. They are presenting pipes to engineers who use their metals, also to a number of those who should use them. The bowl of the pipe bears the inscription, "Sold on Merit—Dominion Babbitt Metals." A large number of the fraternity have been enjoying good quiet smokes as a result.

# Trade Gossip.

**Mr. Lacey R. Johnson** has been appointed general superintendent of the Angus shops district, C.P.R., and is succeeded as assistant superintendent of motive power by **Mr. H. Osborne,** late superintendent of the locomotive shops.

**The Bawden Machine Co.,** Orillia St., Toronto, are erecting a factory on Stirling road, which is expected to be ready for occupancy in September of this year.

**The Imperial Steel & Wire Co., Collingwood, Ont.,** may head an amalgamation of wire concerns, according to reports being circulated. The merger would include three independent wire mills. President J. A. Curries, president of the Imperial Co., states that there is some truth in the reports, as negotiations are under way for the acquisition of other mills by his company, but that matters are not far enough advanced for the publication of details. The Imperial Co. recently paid a 20 per cent. dividend and has enlarged its preferred stock capital by $300,000. It has no bond issue or other fixed charges and is in an excellent position to carry out the project. At a recent meeting of Canadian manufacturers of wire nails, the list of extras was changed. Everything in the 5 and 6-inch list were made the base; all in the 4-inch class were advanced 5 cents, and in the 3-inch class, 10 cents per keg.

**The Can-British Engineering Co., Ltd:** has been recently formed to carry on the business of an engineering supplies and construction corporation in the Dominion of Canada. It will establish branches in all the principal centres, at each of which stocks of standard appliances, spare parts, etc., will be carried. The intention of the company is to undertake contracts for the supply and erection of all classes of machinery, and to purchase the plant required, as far as possible from leading makers in the United Kingdom. The subscribed capital is $1,000,000, and in addition to a headquarters board of directors in England, a local board in Canada is also provided. This latter consists of Mr. W. A. Martin, managing director, of Toronto, late assistant general manager Toronto Electric Light Co., Mr. Ernest M. Sellon, Montreal, director of Mathews, Wrightson & Co., (Canada, Ltd); Mr. Charles Ruttan, Winnipeg, of Ruttan & Chipman, financial & commercial agents; Mr. Nichol Thompson, Vancouver (manager for Western Canada, Cammell, Laird & Co., Ltd.

**The Smart-Turner Machine Co., Ltd., Hamilton, Ont.,** have recently secured the following orders:—The Hamilton Bridge Works Co., duplex pump; The Terra Cotta Pressed Brick Co., Ltd., Toronto, duplex pump; Lothbiniere & Megantic Railway Lyster, Que., duplex brass fitted pump; The Corporation of Dundas, centrifugal pump; The Oliver Chilled Plow Works, Hamilton, centrifugal pump; The International Harvester Co., Hamilton, duplex end outside packed plunger pump with pot valves; Rixon, Ainslie, Stoddart Co., Ltd., Owen Sound, Ont., duplex pump; Dominion Canners, Ltd., Hamilton, duplex pump; Town of North Toronto, Ont., centrifugal pump; J. S. Mundell & Co., Elora, duplex pump.

**The Vulcan Engineering Sales Co., of** Chicago, announce that it has taken the selling agency for the line of structural and plate working machinery,—Punches, shears, rolls ,bulldozers, etc., manufactured by the Rock River Machine Co., Janesville, Wis. This is in addition to the lines already controlled, which include the product of the Hanna Molding Machine Works, pneumatic riveters; Mumford Molding Machine Co., molding machines and foundry equipment; G. M. S. Co., metal sawing machinery and shop equipment. The Vulcan Engineering Sales Co., make a specialty of machinery for structural and boiler shops and foundries.


STEEL CASTINGS

Acid Open Hearth Steel for Locomotive and Machinery Castings.

Stock Process Steel for Automobile and Light Castings of all descriptions.

**Our plant will be in operation early in October.**
(Annual Capacity, 12,000 tons.)

***Let us figure on your requirements.***

**The Dominion Steel Castings Company, Limited**
HAMILTON, ONTARIO

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

**FOUNDRY AND MACHINE SHOP.**

**Hamilton, Ont.**—The Imperial Car Company, a Canadian organization, in which local financiers are heavily interested, has purchased a fifty-acre site here and will erect a plant to cost nearly a million dollars, for the purpose of manufacturing steel and wood freight cars. The company has an authorized capital of $6.-000,000.

**Toronto, Ont.**—The Hamilton Gear and Machine Co. has secured a permit to erect a $2,-500 one-storey machine shop at the corner of Van Horne and Concord Avenue.

**North Vancouver, B.C.**—The opening up of a means of communication with the large zinc deposits of the Western Dominion Land and Investment Co. at the head of Lynn Creek, gives apparent possibility that a smelter will be established soon. The plant will cost about $150,000.

**Owen Sound, Ont.**—Work has commenced on a nut and bolt factory which will employ about 400 hands. The plant is being built near the site of the C.P.R. elevators which were burned down last autumn.

**New Liskeard, Ont.**—It is understood that the Wabi Iron Works Company will re-organize and establish a new foundry on a site adjoining the railway tracks. A considerable sum of money has been put into the business by outside parties and the prospects are sufficiently bright to ensure at least fifty men being employed.

**Halifax, N.S.**—Fire recently did damage to the extent of between eight and ten thousand dollars at the plant of W. and A. Moir, engineers and machinists. All the patterns were destroyed. Loss is covered by insurance.

**Sydney, N.S.**—The Dominion Coal Company are making a big addition to their car shops at Glace Bay. They have also recently completed the erection of twelve miners' houses and three officials' residences at the Birch Grove Collieries.

**Port Colborne, Ont.**—The Canadian Union Furnace Company have started work on their large plant here. They have let contracts totalling close to half a million. The plant is expected to be finished by the close of the present year.

**Sarnia, Ont.**—The work of building the new street car barns for the Sarnia Street Railway has been started by the contractors. The buildings will be constructed entirely of concrete blocks and will have a gravel roof. A separate machine shop will be built for making repairs to cars. The cost will be over $12,000.

**Hamilton, Ont.**—Work has been commenced on the plant of the National Car Company and will involve an outlay of $300,000. The promoters recently gathered at Montreal and appointed the following officers:—President, Sir John M. Gibson; Directors, J. J. Scott, K.C., William Southam and Basil Major. The principal building in connection with the plant will be 200 by 520 feet, and this it is expected will be ready for occupation by October the 15th.

**Welland, Ont.**—The Metal Chemical Company, Limited, are about to locate an electric smelter plant here, together with ten acres of land adjoining the chosen site. The following men are behind the venture:—J. W. D'Angero, M. E. D'Angero, J. H. Charles, and G. W. Vaness.

**Fort William, Ont.**—W W Butler, of the Canadian Car and Foundry Company has opened temporary offices here and will undertake at once the direction of the million dollar car foundry about to be built.

**Sherbrooke, Que.**—H. G. James architect, Sherbrooke, has prepared plans for the construction of a foundry, boiler and machine shop for the Sherbrooke Iron Works Co. A. G. Campbell is manager.

**Owen Sound, Ont.**—The Northern Bolt & Screw Co. will call bids shortly for the erection of a new factory 83 x 220 ft. J. H. Cole is manager.

**Georgetown, Ont.**—The Georgetown Foundry Co., Charles Young, manager, will have plans prepared at once for a large iron foundry.

**Edmonton, Alta.**—Morehouse & Nesbitt, Jackson Block, Edmonton, have prepared plans for the erection of a new machine shop and foundry to cost $60,000 for the Western Foundry & Machine Co. Benjamin Olsom is general manager.

**East Kildonan, Man.**—The Grigg Mfg. Co., Minneapolis, Minn., will build a new $100,000 plant for the manufacture of farm implements at East Kildonan.

**St. John, N.B.**—The management of the Union Foundry and Machine Works are making preparations to enlarge the plant to a considerable extent. Mr. George H. Waring is president and manager of this concern.

**Prescott, Ont.**—The Grand Trunk Railway has signed a provisional agreement to move its shops from Brockville to Prescott; also to make the latter town a divisional point. The agreement was executed by the mayor for the town, and by its terms, the municipality is obliged to meet certain named conditions. No difficulty is expected in voting the required by-law on the part of the ratepayers. The anticipated change will be a boon to the city of Prescott. The railroad proposes to proceed at once with the building of a repair shop and roundhouse.

**Brockville, Ont.**—A carriage company has begun the manufacture of automobiles. The machine is called the Atlas. The motor, wheels, chassis, and nearly all other parts are imported from the United States and assembled in Brockville. The body of the car is manufactured at the local shops.

**Welland, Ont.**—B. J. McCormick, Industrial Commissioner, announces the location in Welland of the Northern Steel Co., Limited, with a capital of $1,200,000. It will erect rolling mills for rolling sheets and black plate. The main building, 150 feet by 600, 85 feet high, will be equipped with a ten-ton crane. Other smaller buildings will be erected on the property. The construction of the plant will begin at once, with the object of opening in February. The only concession granted the company was fixed taxation. It will locate in the southeastern port of the town, on a portion of the Kennedy property, and will have switches from the Michigan Central, Wabash, Grand Trunk, T. H. & B., and Canadian Pacific Railways. Fifteen acres of land have been purchased. There was considerable competition to secure this plant from other towns and cities which were offering bonuses, bond guarantees, etc, but the cheap power and the close proximity to Pittsburg, giving cheap rail freight rates, and allowing a low cost of production, were a combination which secured the mills for Welland. W. R. Glasgow, formerly Works Manager of the Canadian Steel Foundries, Welland, will be general manager. The present offices, which are in the Traders Bank Building, Toronto, will remove to Welland as soon as construction begins.

**Windsor, Ont.**—The White Machine Works Limited has been incorporated with a capital of $40,000 to manufacture and sell all kinds of saw mill and planing mill furnishings, sharpeners and machinery in general, with head office at Windsor. The provisional directors are A. E. White, of Eau Claire, Wis., E. S. Wigle, barrister, and Dr H. R. Casgrain, of Windsor, Ont

**Montreal, Que**—Aberdeen Estates Limited have been incorporated with a capital stock of $250,000 to carry on business as contractors, builders, electricians, mechanical engineers, etc., with head office at Montreal. The incorporators are A. H. Duff, W. A. Merrill, and R. Burnett, advocates, all of Montreal.

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## U.S. RAILWAY BUSINESS FOR MAY

FOR the month of May, the net operating revenue of U.S. railways declined five and five-tenths per cent. per mile of line as compared with May 1911, and that for May 1911, was four and eight-tenths per cent. less than for May 1910. This is the salient fact of the monthly summary of the Bureau of Railway economics, compiled from the reports of the railways to the Interstate Commerce commission, and embracing ninety per cent. of the steam railway mileage of the country.

The total operating revenues were $226,109,262, an increase of $7 per mile of line over May, 1911. The operating expenses were $161,368,677, an increase of $24.29 per mile of line, while the net operating revenue was $64,740,585, a decrease of $17.23 per mile of line. Taxes amounted for the month to $9,897,301, or $45 per mile; an increase of nine and two-tenths per cent.

The decrease in net operating revenue was most severe for the Eastern group of railways, amounting to eleven and nine-tenths per cent. For the Southern group it increased four-tenths of one per cent., and for the Western group less than one-tenth of one per cent. The aggregate of the net operating revenue for the eleven months of the fiscal year, and also for the five months of the calendar year, when measured per mile of line, shows a decrease in comparison with the corresponding periods of the previous year.

## PATENTS GRANTED.

BELOW will be found a list of all patents recently granted in Canada relating to mechanical engineering and iron and steel foundry practice, furnished by Fetherstonhaugh & Smart Castle Bldg., 53 Queen St., Ottawa, Canada.

141,477.—Thos. Edwards, Ballarat, Victoria.—Tilting roasting furnaces.

141,483.—S. Gibson, Porcupine, Ont.—Beat propulsion.

141,484.—Thos. W. Green, Philadelphia, Pa.—Rotary blowers.

141,485.—Thos. W. Green, Philadelphia, Pa.—Divided impellers for blower.

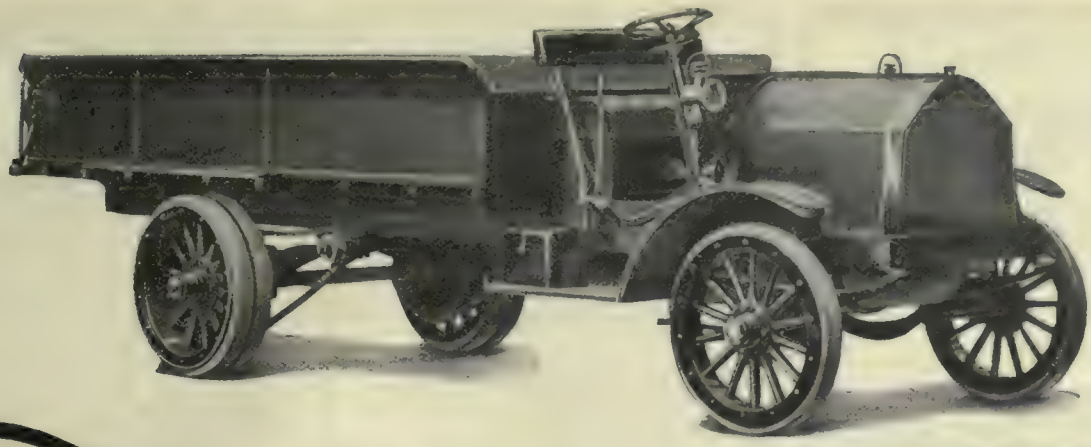
141,490.—S. Hato, Seattle, Wash. — Display apparatus.

141,493.—D. H. Henderson, Baldwinsville, New York.—Shaft couplings.

141,495.—P. Jorm, Hamburg, Germany —Railroad track scale.

141,506. — Wm. C. Martyn, 23 Alma Road, St. Kilda, Victoria, Australia.—Tractors.

141,508.—Jno. T. Metcalfe, Quincy, Pa.—Friction clutches.



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**Built for Canadians with Canadian Money.**

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### Cost of Equipment and Operation of One 6-Ton Truck for Five Years

**Capacity: 144 tons per day.**

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|---|---|
| 1 Six-ton truck | $ 5,500.00 |
| Gasoline averaging 36 miles per day, 300 days per year, at 6 miles per gall. (16½c. per gall.) | 1,485.00 |
| Oil at 50c, 120 miles to the gallon | 225.00 |
| Grease average at 15c pound, running 1 lb. to 100 miles | 81.00 |
| Repairs and repainting, $75.00 per year | 375.00 |
| Tire replacement average 8,000 miles per tire (150 per tire) | 4,200.00 |
| Oil for lamps at $20.00 per year | 100.00 |
| Incidentals at $25.00 per year | 125.00 |
| Liability and Fire Insurance $150 per year | 750.00 |
| Driver at $2.50 per day; $780 per year | 3,900.00 |
| License at $2.00 | 10.00 |
| Depreciation at 20 per cent | 5,500.00 |
| Interest at 6 per cent. | 1,650.00 |
| Battery charging at 50c per month | 30.00 |
| Total | $23,931.00 |

### Cost of Equipment and Operation of Four Teams and Wagons for Five Years

**Capacity: 120 tons per day.**

| | |
|---|---|
| 4 Teams at $500.00 | $ 2,000.00 |
| Coal wagon at $225.00 | 900.00 |
| Harness at $40.00 | 160.00 |
| Wages of drivers at $2.00 per day | 12,000.00 |
| Repairs to harness $10.00 per set | 200.00 |
| Feed, Vet. services, stabling, shoeing, etc. at $25.00 per horse per month | 12,000.00 |
| Repairs to wagon at $25.00 per year | 500.00 |
| Insurance 2 per cent. on horses and wagons | 305.00 |
| Interest on investment at 6 per cent. | 1,830.00 |
| Depreciation on wagons and harness 2 per cent. per annum | 1,060.00 |
| Depreciation on horses 40 per cent. per annum | 4,000.00 |
| Total | $34,955.00 |

**SUMMARY.**

| | |
|---|---|
| Total cost of maintenance and operation of 4 teams and equipment for 5 years | $34,955.00 |
| Total cost of maintenance and operation of one six-ton truck for 5 years | 23,931.00 |
| Total saving in 5 years | $11,024.00 |
| Net annual saving in favor of the six-ton truck | $ 2,204.80 |

**Perhaps the same logical reasoning can be applied to your business?**

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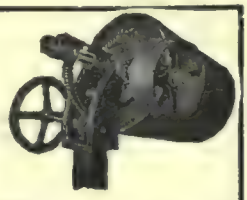

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TORONTO MONTREAL WINNIPEG
ST. JOHN, N.B. VANCOUVER

**Edmonton, Alta.**—Edmonton is to have a new industry in the shape of a brass foundry, which will be in operation by the fall, according to Mr. Solsbaug, of the Boston firm of Clark & Solsbaug, who is now in the city completing arrangements for the purchase of a site. This firm has been in communication with the board of trade for some time and from information given by the secretary of that body, has decided that Edmonton is a most favorable spot in which to locate a growing industry.

**Battleford, Sask.**—That Battleford secures the location of The Eby Foundry Company plant, is the announcement made recently by Commissioner A. A. Leslie. This company will erect a modern foundry and moulding plant. The site selected is the property immediately adjoining the Battleford Iron Works Co. premises on the west, which location affords excellent trackage and easy shipping facilities.

### MUNICIPAL.

**Saltcoats, Sask.**—The electric light by-law calling for an outlay of nearly $20,000 has received the sanction of the ratepayers.

**Melfort, Sask.**—Three money by-laws totalling $125,000 for waterworks, sewage disposal and electric light were carried unanimously.

**Saskatoon Sask.**—The by-law to raise $500,000 for the construction of a street railway system received the sanction of the ratepayers.

**Blyth, Ont.**—The waterworks by-law to raise $5,000 by debentures for expenditure in laying water mains and consolidate the overdraft from 1911 has been passed.

**Wainwright, Alta.**—A by-law for the erection of a $25,000 flour mill was carried.

**Outlook, Sask.**—The ratepayers have decided to raise $15,000 by debentures for the purpose of installing an electric lighting system.

**Fernie, B. C.**—The ratepayers rejected an electric extension by-law.

**New Westminster, B. C.**—The ratepayers recently passed seven money by-laws aggregating in all $1,190,000: Harbor, $500,000; Street, $250,000; Gas Plant, $225,000; Hospital, $100,000; Waterworks, $75,000; Parks, $25,000; Storehouse, $15,000.

**Ottawa, Ont.**—The by-law to raise $66,500 re construction of new water mains recently received the assent of the ratepayers.

**Humboldt, Sask.**—A by-law was passed by the ratepayers whereby $8,000 will be raised as a loan to the Carberry Sash and Door Factory.

**Fort William, Ont.**—The burgesses passed the following by-laws:—To bonus the Canada Car & Foundry Company to the extent of $250,000; $253,000 re extension of water works system; $200,000 for street railway extensions; $14,000 re fire system; $57,000 re agreement with A. M. Hanton; and $16,000 re bonus to Great West Wire Fence Company.

**Chilliwack, B. C.**—The ratepayers recently passed the waterworks by-law.

**Owen Sound, Ont.**—The two industrial by-laws recently received the assent of the ratepayere. They provide for the raising of $20,000 in aid of the Superior Match Company.

**Berlin, Ont.**—The ratepayers voted in favor of raising $25,000 to bonus the Canadian Consolidated Rubber Company.

**Halbrite, Sask.**—The council have authorized the issue of debentures for $3,000 re aid to the tin tub factory.

**Parkhill, Ont.**—The waterworks by-law whereby $25,000 will be raised received the endorsement of the burgesses.

**Gananoque, Ont.**—The town is to have a new drill hall. A parliamentary appropriation was made at the last session and the contract, amounting to $13,000, has been let to John Dillion.

**Humboldt, Sask.**—The contract has been let to A. E. Pike for the erection of a new town hall here. The price is $29,150. This will include the entire work except the cost of a few cut stones which will be supplied by the city.

**Kerrisdale, Point Grey, B. C.**—The committee of the council has confirmed the award of the large sewerage contract to Messrs. McLean and Company at $156,000. Provision is made for the work to be completed within seven months

### ELECTRICAL

**Regina, Sask.**—Fred H. Everett has commenced operations on the erection of a new warehouse and grist mill and will operate it by electric power.

**Quebec, Que.**—The power plant of the Quebec and Jacques Cartier Electric Company at St. Gabriel de Brandon was completely destroyed by fire recently. The loss is about $50,000.

**Vancouver, B. C.**—The British Columbia Electric Company recently called tenders for dismantling a number of old brick buildings on Pender street here, but since then, plans

have been changed, and it is now proposed to remodel the old buildings and turn them into stores and offices. The company are also building a sub-station which will be ready for service by the end of August. The total cost of building and machinery will be $125,000.

**Woodstock, Ont.**—A grand celebration marked the occasion of the turning on of the Hdro-Electric lights here recently by the Hon. Adam Beck. The lights are five globe standard, and Woodstock is now lighted similarly to Toronto, Hamilton, and London.

**Saltcoats, Sask.**—The ratepayers have of late voted $20,000 toward the installation of an electric lighting system.

**Galt, Ont.**—The sum of $45,000 was recently voted by the burgesses toward the cost of the completion of the Hydro-Electric system.

**Kingston, Ont.**—Following the arrangements made between the Gananoque Board of Trade, Town Council and Gananoque Water Power Company, each to assume one-third of the estimated cost of $500 to have an engineer make calculations on the amount of electrical power that can be generated by the Gananoque River for use as motive power by the manufacturers of the town, Engineer Robertson, of Montreal, has been at Gananoque and Marble Rock making estimates.

**Sasaktoon, Sask.**—By the latter part of September the capacity of the Saskatoon power plant will be 5,077 horse power. There recently arrived from the Allis-Chalmers Company, of Milwaukee, a new steam turbine engine and four cars of boilers. This new equipment will add to the capacity of the power house, 3,000 horse power.

**St. Mary's, Ont.**—Chairman Weir, of the water, light, and heat commission, reports many applications from farmers for power and light since he made public announcement that the board was prepared to give power and light to all farmers within the corporation limits.

**Toronto, Ont.**—The city council has instructed the city architect to prepare plans and specifications for the erection of a municipal abattoir and cooling plant. An expenditure of $300,000 is proposed.

**Winnipeg, Man.**—Ratepayers of Winnipeg, Man., will vote on a by-law to provide $750,000 for extensions to the power and light distribution system of the city. H. N. Ruttan is city engineer.

**Welland, Ont.**—Welland recently turned on the power in the new waterworks plant, which was built at a cost of $75,000, and is a model of its kind. It is entirely apart from the old plant, but both will be kept in commission. The new plant has a capacity of three million and a half gallons daily and is arranged so that it can be increased to ten million gallons daily.

**Fredericton, N.B.**—For some years enterprising men of this community have believed that there were great power possibilities at Meductic Falls on the St. John River about 40 miles above Fredericton. Last winter a company headed by a St. John capitalist, incorporated the St. John River Hydro-Electric Co. to develop this power. A Canadian hydraulic engineer has inspected the dam site, and plans are under way for immediately developing 10,000 horsepower, which will be sold along the St. John Valley, particularly in Fredericton and St. John. With cheap power, industrial expansion may be expected.

**Calgary, Alta.**—Applications by the city of Calgary to construct an $8,000 electric light sub-station, and by the Wilson Furniture company for a $66,000 warehouse were the principal items at the office of City Building Inspector Sylvester, recently.

**Kingston, Ont.**—The Seymour Power Co. purposes making another proposal to supply power to Kingston. It has had experts here looking over the ground, so that the offer will be as fine as can be drawn.

**Brockville, Ont.**—At a special meeting held recently, the town council authorized the mayor and clerk to sign a contract with the Ontario Hydro-Electric Commission for the transmission of cheap power to Brockville. It is expected that the power will be ready for delivery here by the first of the New Year.

### GENERAL MANUFACTURING. ....

**Welland, Ont.**—Prof. Richardson, Toronto, of the Electro-Chemicals Co., Ltd., has arrived to lay out the ground for the new plant here, the company having purchased a plant and 15 acres of land. Buildings will be proceeded with at once.

**Hardisty, Man.**—A plan is being considered by which it is hoped a brick plant will shortly be established here.

**Sault Ste. Marie, Ont.**—Fulfilling the agreement made by the Lake Superior Pulp and Paper Company with the city, the company's mills are now being operated. If the output


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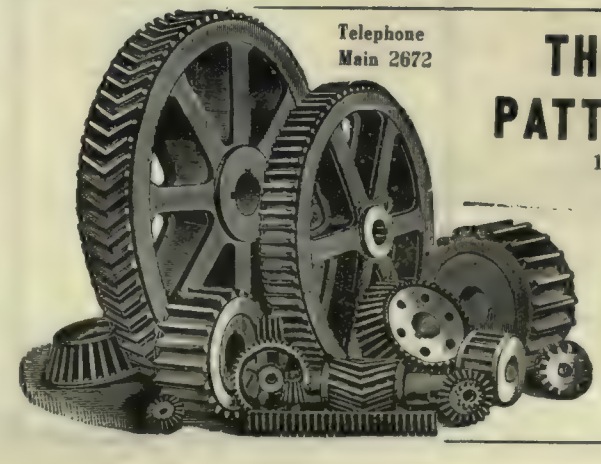
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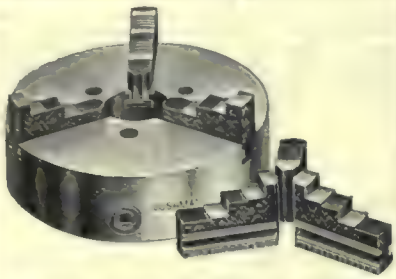

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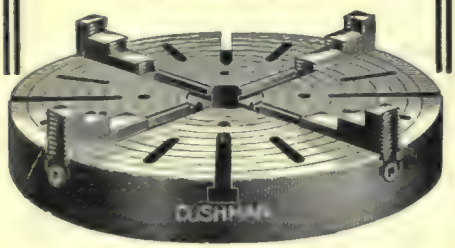


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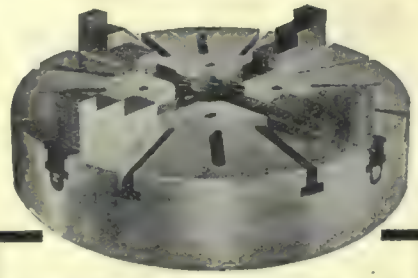

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We maintain that *no* test is too severe for the

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and we know you will agree with us, once you have tried it.

May we send you one, carriage paid, on 30 days' FREE TRIAL? Use it in your shop, test it any way you can think, and if it won't do all you ask of it, and more, send it back *at our expense.*

Let us have your request for a FREE TRIAL of the "Imperial." Write us to-day.

Send for catalogue.

**Ker & Goodwin**

Brantford, Canada


of the mill is satisfactory on the initial run, paper will be at once placed on the market. The expectation is to turn out about 200 tons per day.

**Toronto, Ont.**—Messrs. Rolph and Clark recently purchased a lot on Carlaw avenue, here, upon which it is proposed to erect buildings for a lithographic plant to cost $150,000 and to employ about 225 men.

**Levis, Que.**—A new industry is about to commence operations here to be financed by Canadian, French, and Belgian capitalists. The company is asking the municipality for a suitable site.

**Ottawa, Ont.**—A firm known as the Try Me Tire Company is about to start business on Sparks street here. The promoters are Messrs. F. B. Carling, and Eric McLaghlin of Ottawa. The principal business of the company will be the repairing of automobile tires

**Berlin, Ont.**—As a result of the bonus by-law recently carried here, the Consolidation Rubber Company will receive a grant of $25,000 and will commence at once the building of a $250,000 plant.

**Palmerston, Ont.**—Charles Kreutziger, of Waterloo, Ont., has purchased the old carriage company's property here and will start at once the manufacture of trunks. Fifty workmen will be employed.

**Ripley, Ont.**—The Ripley Flax Comapny has decided to run the flax mills again this season. They have from 150 to 300 acres of flax under cultivation. The plant employs during the summer about 50 persons, and in the winter about 25. During the previous season, the Ripley Flax Company manufactured from 30 to 40 tons of dressed flax, about 15 to 25 tons of green tow, and 2,500 bushels of seed.

**Picton, Ont.**—Six new canning factories have recently been established at the following points:—South Bay, North Port, Picton, Consecon, Wellington, and Bloomfield.

**Belleville, Ont.**—A new industry is about to start business here. The industry will manufacture coke and wood alcohol. It will give employment to about sixty men, and is capitalized at $500,000.

**Toronto, Ont.**—Owing to the civic authorities failing to complete the deal for the nursery property at the corner of King and Dufferin streets, the Toronto Carpet Company will leave the city and concentrate its efforts at Peterborough or St. Catharines. It employs about seven hundred men.

**Camrose, Alta.**—The Camrose Clay and Lumber Products Co. Ltd., has been fully organized and will commence at once the manufacture of pressed bricks. The company is incorporated in the province of Alberta and capitalized at $100,000. They will install a plant capable of manufacturing 100,000 pressed bricks per day.

**Victoria, B. C.**—Construction has been started on a cement plant at Saanich Inlet, which will have a capacity of two thousand barrels daily. It will employ two hundred and fifty men.

**Guelph, Ont.**—The Raymond Manufacturing Company are enlarging their building with a one-storey addition. The Taylor-Forbes Company is also enlarging their industry by an additional one-storey steel and brick building to cost $5,000.

**St. Thomas, Ont.**—W. E Wilson and Ernest Cummings, both formerly of Galt, are about to commence the manufacturing of shoes here. They are requesting a bonus of $12,500 from the corporation and will commence at once the erection of a factory 100 feet by 40 feet, and two storeys high. The firm will be known as the St. Thomas Shoe Company.

**New Hamburg, Ont.**—It is reported that a new furniture factory is to be started in New Hamburg by a number of old New Hamburgers, provided they get some inducement from the town. The men at the head of the affair are all experienced in this line of business.

**Hanover, Que.**—The factory of Glaiser & Leinberger, manufacturers of parlor frames, was damaged by fire, July 8. Loss $2,000.

**Bridgeburg, Ont.**—The Canadian Jewett Refrigerator Co., Ltd., has been incorporated with a capital stock of $50,000 by Edgar B. Jewett, John E. Jewett and Robert F. Buckley of Buffalo, N.Y., as provisional directors, and will build a plant for the manufacture of refrigerators near the International Bridge.

### SAW AND PLANING MILLS.

**Peterborough, Ont.**—The plant and buildings of the Mann Lumber Co., have been purchased by Mr. A. H Stratton. The plant, an up-to-date one, is being put in first-class condition for operation. Some repairs are necessary owing to the recent fire. As soon as these have been made, it is expected the mill will be open for business.

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will give parties in Canada the best opportunity they have had to attend the conventions and see the exhibits since the meeting in Toronto, in 1908. The Exhibits have doubled in size since then and will be a big attraction at Buffalo.

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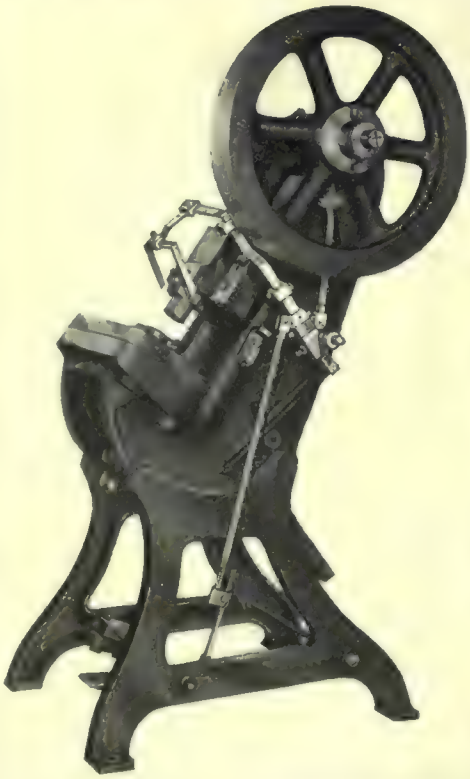

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**West Lahave, N.S**—The wood-working plant and sawmills of Boehmr Brothers were recently destroyed by fire. The mills were among the best in the province. Damage to the extent of $60,000 was the result, and no insurance was carried.

**Toronto, Ont.**—Harry Hope's planing mill at 498 Concord avenue was burned a short time ago. The total damage is $3,500, of which insurance is carried to the extent of $2,625. The origin of the fire is unknown.

**Kenora, Ont.**—A fire entailing the complete loss of the Rat Portage Company's saw mills occurred here recently. Several thousand feet of lumber in the mill vicinity was fire swept during the conflagration. The cause of the fire, which is the worst in the history of the town for some time, is said to have originated near a bandsaw.

**Nelson, B. C.**—Directly the plans have been completed, tenders will be called for the construction of a new mill at the Hewitt mine at Siverton to replace that recently destroyed by fire.

**Thornloe, Ont.**—Fire of unknown origin recently destroyed 550,000 feet of lumber and 30,000 feet of saw logs at the mill owned by Mr. Neely. The total loss is estimated at $15,000.

**Haliburton, Ont.**—One of the finest saw mills in this district was recently destroyed by fire. The mill, known as the Wm. Laking Mill, was damaged to a great extent. $8,000 insurance was carried.

**West Toronto, Ont.**—Batt's planing mill was recently damaged by fire, the origin of which is unknown. The firemen's quick response was the means of checking the blaze before much damage was done.

**Weyburn, Sask.**—The Weyburn Sash, Door and Glass Company have of late opened for business. They have installed a 50 h.p. electric motor and will employ between twenty and thirty men.

**Collingwood, Ont.**—The tug Balize arrived from Shawanaga with a raft of logs numbering over 50,000 pieces for the Kent-Cooper Co. The mill began running and will continue until the fall.

**Bathurst, N. B.**—J. Bennett Hochey, of Bathurst, bought the large shingle mill here together with the rights to cut cedar over certain properties, also a large block of timber lands for the sum of $17,600.

**Toronto, Ont.**—A fire, which did damage to the extent of $1,500, broke out at the J. C. Gilchrist Planing Mills on Perth ave., recently What started the fire is not known. The fire department soon had it under control. The loss is covered by insurance.

**Toronto, Ont.**—Willis K. Jackson, a wealthy lumber merchant of Buffalo, has purchased two townships in Northern Ontario from the Ontario Government for $98,364, at one dollar an acre. Acting upon a plan to secure private capital and private enterprise in the work of colonizing the unsettled portion of the province, the Government has entered into an agreement with Mr. Jackson whereby the Townships of Haggart and Kendry are sold on the understanding that the land will be immediately cleared, sawmills costing over $70,000 erected, and settlers brought into the district. Undoubtedly this is the most important step thus far in connection with the Government's colonization scheme. The purchaser must commence within 90 days from the date of the agreement and complete with reasonable despatch a permanent sawmill, planing mill, sash and door factory, all of which will cost something more than $70,000.

**Fort George, B.C.**—Another industry is about to start operation here in the form of a sash and door factory. The promoters are F. Wegley, R. A. Pooley, and S. Pooley, who will constitute the new firm to be known as the Fort George Sash and Door Factory.

**Port Hope, Ont.**—Fire recently damaged the planing mill of L. E. Hall and did considerable injury to the machinery The cause of the fire is unknown. The loss amounts to $1,500, and is covered by insurance.

**Pictou, N. S.**—The plant of the Atlantic Milling Company was recently destroyed by fire. The total loss is about $28,000 and the insurance about $13,000. The concern which was incorporated two years ago, as a joint stock company, has been doing a large business and will rebuild at once on a bigger scale.

### BUILDING NOTES.

**Camrose, Alta.**—Work on the foundations of a new $100,000 normal school for Camrose will be commenced this fall, according to Hon. J. R. Boyle, Minister of Education, who spent Wednesday here and made the announcement before he left.

**Portage La Prairie, Man.**—The Hart-Parr Company will erect a new warehouse to cost in the neighborhood of $5,000 in this city, and instructions have been given to their

architect, C. H. Mounsey to proceed with the plans and call for tenders at once. The building will be a solid brick structure, two storeys high, and will be situated on the corner of Gaddy and Victoria streets, the former site of the planing mill. The property was purchased three years ago by the company.

**Portage la Prairie, Man.**—The work of building the drier in connection with the new plant of the Portage Brick and Tile Company at the east end of the city is going on speedily, and in a short time the work will be completed and premises ready for operation.

**Moose Jaw, Sask.**—Building operations will start at once on the new city hall, the tender for which was awarded to Messrs. Navin Brothers for all but the heating and plumbing. The cost of the work is estimated at $25,900.

**Regina, Sask.**—F. Ryan and Company, boot and shoe manufacturers of Winnipeg, have decided to erect a five-storey building here and work will begin immediately.

**Vancouver, B.C.**—The contract for a three-storey reinforced concrete brick and stone-faced, 18-room school for Vancouver Board of School Trustees is about to be let. The school building will be one of the largest of its kind in Vancouver and will cost $150,000. Oil fuel will be used for heating throughout.

**Vancouver, B.C.**—Work has just been commenced on the eight-storey structure of the Y. M. C. A. here. It will occupy a space of 132 feet by 132 feet an dwill cost about $350,000.

**Edmonton, Alta.**—Plans are made and work will soon commence on the erection of a huge business block at the corner of McDougall and Rice streets. The building will be nine storeys high, and will contain 160 offices. Three elevators having a speed of 400 feet per minute will be installed. Over $500,000 is the estimated cost.

**Montreal, Que.**—A new military school is to be established at Dorval, on the island of Montreal, by the Dominion Government. 204 acres having been purchased at a cost of $180,000. Most of the area will be devoted to training officers of the local militia. Plans will shortly be drawn up, and it is expected that work will be started this fall, so that everything will be in readiness for training courses next spring.

**Toronto, Ont.**—The West End Y. M. C. A. building at the corner of College street and Ossington avenue is nearing completion and is expected to be finished by September next It is four storeys high and has about 125 feet frontage on both streets. Thirty-one distinct contractors are engaged on the building, which will cost slightly over $100,000.

**Toronto, Ont.**—The Home Life Association of Canada is going ahead with extensive and elaborate plans to add to their present buildings at the corners of Adelaide and Victoria streets. Nothing definite has been decided, but it is possible that a sixteen storey building will be erected.

**Port Arthur, Ont.**—It is reported that a Roman Catholic cathedral will be erected at the corner of Arthur and Algoma streets in the near future. As soon as specifications can be prepared, tenders will be called and work commenced as soon as possible thereafter.

**Vancouver, B. C.**—A girls' residential school is about to be commenced here. The school which is to bear the name of "Braemar" will be one of the finest of its kind in the province. There will be, as it were, two buildings—the school and the residence. Messrs. McLure and Fox are the contractors and according to their estimation the buildings will cost $115,000.

**Vancouver, B. C.**—A bank building, to cost approximately $100,000 will soon be erected at the corner of Carrall and Hastings streets for the Merchants Bank of Canada. It will be three storeys high, but will be designed to carry seven more floors.

**Simcoe, Ont.**—The York county engineers who act as consulting engineers for Simcoe, are now preparing designs for six new bridges to be built in that county this summer. One of these is to be of the concrete truss type, and will be located near the village of Nottawa, not far from Collingwood. The other five will be steel structures of expensive design.

**Vancouver, B. C.**—Work has started on the new St. Paul's Hospital. The building will be five storeys high and will be modern in every way. It will cost about $200,000, and will be ready by January next.

**Toronto, Ont.**—Authority has been given the Board of Control to purchase a site for the proposed detention house for the insane, to cost about $100,000. It is expected that work will be started soon on the erection of a building.

**Winnipeg, Man.**—A permit has been taken out for the additional two storeys on the W.


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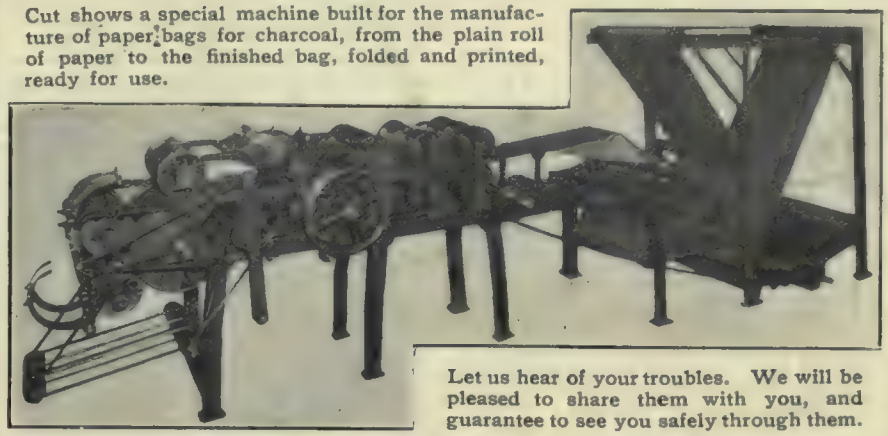

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J. Boyd building. The total cost of the building will be $250,000.

**Regina, Sask.**—Negotiations are taking place between the Trade and Commerce Department and several Canadian and American manufacturers of elevators for the construction of the new Government terminal elevator at Regina. It is to cost two million dollars, and to hold three million bushels. While the main building will be constructed this season, it is not expected that the drying plant will be in use until next year. Tenders will be called for immediately.

**Saskatoon, Sask.**—A large block is about to be constructed here by Frank Cahill who has bought much property here. The size of the building is to be 135 feet by 130 feet and will be two stories high with provisions for an additional eight floors. The ground floor will be taken by stores, whilst the top will be used for offices. The cost is about $75,000.

**Dunsmuir, B. C.**—Among the several large buildings which Edward J. Ryan is about to erect are two buildings of very large proportions. One, an eight-storey apartment block which will cost $100,000, is to be built at the corner of Granville street and Twelfth avenue. The other building, at the corner of Dunsmuir and Seymour streets, will cost about $200,000. L. Melikoff is the owner.

**Vancouver, B. C.**—The chief losses occasioned by the recent big fire are:—Champion and White builders' supplies, $450,000; Canada Malleable Steel Range Company $75,000; Commercial cars in Motor Company's warehouse, $225,000; British Columbia Railway, $50,000; Tudhope Motor Company $30,000; and Palmer Investment Company, $75,000.

**Saskatoon, Sask.**—A block to be known as the Farnam block is about to be started here. The structure will be of solid brick and will be three storeys high. The cost of the building will be about $20,000.

### THE EASTERN CAR CO.

Mr. Charles Cantley, assistant to the general manager of the Nova Scotia Steel & Coal Company, was in Montreal recently and reported that active preparations are afoot for the construction of the plant of the Eastern Car Company, which will go into the manufacture of steel cars. The plans for the building, which will cover about fourteen acres of ground, are well in hand, and Mr. Horace H. Lang, consulting engineer, who has planned many big American plants, is now on the ground. The site selected is close to the present Scotia plant at Trenton, a suburb of New Glasgow. Mr. Cantley reports that the recent additions to the Scotia plant both at Trenton and Sydney Mines are working splendidly and justifying the heavy outlay incidental to the installation. Mr. Charles Cantley is a graduate of the Science Faculty of McGill, and a son of Mr. Thomas Cantley, General Manager of the Nova Scotia Steel & Coal Company. He was recently appointed assistant to the General Manager. Nova Scotia Steel is directly interested in the Eastern Car Company as it will supply all the raw material entering into construction.

### THE RUSSELL MOTOR CO.

The Russell Motor Company has taken out a permit for a new building at its plant at Toronto Junction which is to be erected at a cost of $75,000. Work has already been commenced and operations will be rushed to a completion. The new structure will be a factory of four storeys, 170x120 feet in dimensions, being of re-inforced concrete with a maximum of light and equipped with every contrivance characterizing modern factories. The first floor will be devoted to a machine shop, the second an assembly for intricate parts, the third for rough parts and the fourth a finishing department. The new building will mean a considerable increase in the volume of the output of the firm, as also in the number of hands employed. About 1,200 are now engaged, and on the completion of the building, 150 additional will be required. The business of the firm continues to be brisk and the general outlook is very promising.

### NATIONAL STEEL CAR CO.

Work on the new plant of the National Car Co. at Hamilton is being rushed, and it is expected that the company will be turning out cars early next year. The plant, which will have a capacity of 30 cars a day or about 9,000 cars a year, will be thoroughly up to date besides being well located on the water front with good shipping facilities. There is a good field in Canada for railroad equipment companies, the demands of Canadian railroads being more than existing manufacturers in this country can supply. The railroads are using about 25,000 cars a year. Duty on cars imported from the United States is 30 per cent. It is expected that the cost of buildings, machinery and miscellaneous contingencies will be about $650,000. The balance of the company's funds will be available for working capital. Capitalization is $3,000,000 preferred and a like amount of common stock.

### CATALOGUES RECEIVED.

**The Hisey-Wolf Machine Co., Cincinnati, Ohio,** manufacturers of portable electric machine tools, have mailed us a copy of their latest catalogue, which makes very interesting reading. All kinds of portable electric drills, buffers and grinders are shown, not the least ingenious being a tool post grinder. This is a motor driven grinding wheel arranged to take the place of the ordinary tool post on the slide rest of a lathe. It can be used for grinding lathe centres, milling cutters, reamers, dies, rolls, etc., and also for internal grinding. The catalogue is attractively printed and contains much interesting matter.

**The Independent Pneumatic Tool Co., Chicago, Ill.,** have forwarded several circulars descriptive of the various "THOR" tools manufactured by them. These include piston air drills and wood boring machines, pneumatic chipping, riveting, calking and beading hammers, etc., etc.

**The Rockford Drilling Machine Co., Rockford, Ill.,** have issued an interesting booklet on jigging and tooling. The firm specializes in gang drills and this booklet illustrates the numerous advantages which such a drill has over a chucking lathe for many classes of work. It is well worth perusal.

**The Fosdick Machine Tool Co., Cincinnati, Ohio,** call attention to two circulars which they have recently issued describing their 30-inch and 36-inch National or simple type radial drills. These machines are of the company's latest pattern and have all up-to-date improvements.

**The American Tool Works Co., Cincinnati, Ohio,** have published a booklet bearing the title of "Accuracy Bulletin." In it are described and illustrated the methods taken for securing the high degree of accuracy in "American" machine tools.

**John H. Hall & Sons, Ltd., Brantford, Ont.,** the well-known manufacturers of pipe lathes, nipple machines, roller pipe cutters and special machinery for tube mills have favored us with a copy of a handsome new catalogue which they have just published. It is of the loose leaf variety, excellently printed on faced paper and gives very full particulars of the various high-grade pipe machines manufactured by this progressive firm.

**The Kelly Reamer Co., Cleveland, Ohio,** have issued their 1912 catalogue and net price list. This shows all types of these reamers, which are of the adjustable type with blades of high-speed steel. These reamers, it is claimed, give so accurate a finish that subsequent grinding is never necessary.

**The Curtis & Curtis Co., Bridgeport, Conn.,** have sent us their latest catalogue dealing with the Forbes patent pipe cutting and threading machinery, for hand, belt or electric power. These machines have several features of interest all of which are fully described in the catalogue.

**Henry Disston & Sons, Philadephia, Pa., and Toronto, Ont.,** will be glad to send to parties interested their handy pocket catalog of wood and metal-working saws, all of which are fully guaranteed.

**The British Pacific Supply Co., Victoria, B.C.,** have mailed us an illustrated pamphlet describing the new graphite bearing material which they have recently put on the market. This preparation is known as GRAPHITOL and consists of a fine, dry powder, which, when required for use, is mixed with a prepared liquid into a stiff paste and, without the application of heat, is put into place in the bearing, then formed or moulded, and allowed to set, which it does in from eight to twelve hours. It is claimed that a bearing of great strength is thus formed, in which graphite is the principal ingredient, thus rendering the bearing largely self-lubricating.

### NOTICE

TAKE NOTICE that the Stanyon Metallic Furniture Co., Limited, of the City of Toronto, duly manufactured the movable grate covered by Canadian Patent No. 101,907, and that the Bennet & Wright Co., Limited, of the same city, duly manufactured the hot water heater covered by Canadian Patent No. 107,120, prior to the period called for by the Patent Act, and the said firms are prepared to fill any further orders for the two above inventions at a reasonable price. Ridout & Maybee, Solicitors for Anders B. Reck.

## Classified Advertisements

### MACHINERY FOR SALE

FOR SALE—BATH UNIVERSAL GRINDER with attachments for surface, cylindrical and internal grinding. In first-class shape, 3 ft. table, $275.00 f.o.b. Windsor Machine & Tool Works, Windsor, Ont.

FOR SALE—IDEAL PACKLESS VALVE CO. desire to dispose of their entire business, which is composed of over $9,000.00 worth of valve making machinery, tools and Patterns, also Letters Patent, for a high-grade, simple and durable Packless Valve. Can prove to anyone interested, the value of patent, also that the construction is the most perfect of anything yet on the market, can give references to many well-known people who are now using our valve. Will send printed list of inventory upon application. IDEAL PACKLESS VALVE CO., Walkerville, Ont.

GAS ENGINE FOR SALE—80 H.P. KYNOCH Gas Engine in good order and giving satisfaction. To be sold at good terms for an early buyer. Might also be exchanged for a Corliss Steam Engine of 80 H.P. with 2 return tubular boilers. The engine might be connected with direct generator of same h.p. Also Boiler 30 h.p., in good order, used one year; reasonable price. J. B. & A. Gaulin, St. Francois, P.Q.

MACHINERY FOR SALE—NEW AND SECOND-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

### WANTED

WANTED—EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing measuring instruments, both switch board and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (12y)

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BELTING, RUBBER, CANVAS AND LEATHER, hose packing, blacksmith's and mill supplies at lowest price. N. Smith, 138 York Street, Toronto. (2tf)

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**Canadian Machinery, Toronto**

# Plant of Canada Iron Corporation, Ltd., Fort William, Ont.

By J. H. Williams*

*The enterprise displayed by the management of the Canada Iron Corporation is clearly demonstrated in this plant, which consists of four foundries and a machine shop located at the head of the Great Lakes. The desire to meet the demands of our railroads for car wheels, and of our municipalities for cast-iron pipe, is further exemplified by the establishment of similar plants at various convenient distributing points throughout eastern Canada.*

OF the six plants of the Canada Iron Corporation, Ltd., that at Fort William, Ont., is the largest and perhaps the most interesting, containing as it does the only pipe foundry in Canada operated on the continuous system. It is the leading industrial concern in the city, and gives employment to about 350 men. The various buildings occupy a site of 22 acres on the left bank of the Kaministiquia River, about 5 miles from the City Hall. They comprise machine shop, pattern shop and four foundries for the production respectively of general castings, car wheels, brake shoes and pipe. These four foundries, as may be seen from the plan on page 264, are arranged around three sides of a large cupola room. The latter is 110 feet long by 55 feet wide and contains five cupolas, the pipe foundry having two and the other foundries one each. It will be noted that the charging platform affords ample space for storage of coke, etc. There is a long inclined plane leading to ground level in the foundry yard, pig, scrap and coke being brought up this plane to the charging platform by cable haulage, instead of by the usual elevator. A spiral stairway leads from the charging platform to the ground floor of the cupola room, where are located a large wet cinder mill and the Sturtevant motor driven fans. The latter deliver blast at 13 oz. pressure. All cupolas when worn are patched with mica schist. This is brought in blocks from Pennsylvania and split up into thin slabs on the premises; being found to be both cheaper and more lasting than fire brick.

*Associate editor, Toronto.

### Grey Iron Foundry.

The grey-iron foundry is on the north side of the cupola room, and in the same building as the wheel foundry, both being about the same size—115 feet long by 55 feet wide. The general foundry is served by a 20-ton Niles electric traveler, and the cupola is a 48-inch Colliau. In order not to occupy valuable space on the main moulding floor, the core ovens and core makers are accommodated in an annex on the east side of the building. The capacity of this foundry is 25 tons per day of 10 hours. Brass castings up to 300 lbs. are also made when called for, there being a pit fire in the core room annex for the purpose.

### The Wheel Foundry.

The car wheel foundry is arranged on the circular floor system and has a daily output of 168 wheels, there being seven floors, each pouring 24 wheels. Each floor is operated by one man and a helper, and is served by a 1-ton jib crane. These cranes are now equipped with electric motors, although, at the time our photograph was taken, they were hand operated. The cupola is a 60-inch Colliau, which discharges into a delivery ladle of 8 tons capacity. The latter consists of a brick-lined steel shell mounted on trunnions and is tilted by a worm and worm-wheel operated by hand. On removal from the moulds, the wheels have the gates knocked off and are then taken on hand trucks to the annealing pits, where they remain three days. These pits, 32 in number, have each a capacity of 20 wheels. On leaving the pits, the wheels are cleaned, and then gauged by a standard M.C.B. wheel gauge; after which they are weighed and inspected. Each railroad

GENERAL VIEW OF PLANT FROM PIPE STOCK YARD.

has an inspector on the premises during the execution of its orders for wheels, and he has to O.K. every wheel before shipment.

**Brake Shoe Foundry.**

Brake shoes are moulded in a building measuring 85 feet by 50 feet, situated to the south of the cupola room. This foundry is greatly over-taxed at present, and is about to be very considerably enlarged. The present daily output is about 18 tons. All shoes are moulded on Pridmore draw-pattern machines, and the foundry is served by a 36-inch Colliau cupola.

**The Pipe Foundry.**

The pipe foundry, as previously stated, is operated on the continuous system and has an output of 55 tons of pipe per day. The building stands at the east end of the cupola room and measures 220 feet by 55 feet. It is served by three 10-ton Niles traveling cranes and presents a scene of great activity when in operation. There are two core rooms; cores up to 6 inches diameter being made on the north side of the building, while the larger cores are made on the south side. Each of the two cupolas is operated on alternate days and is in blast from about 9 a.m. to 6 p.m., during which period it melts 50-60 tons of iron. They are of the Baillot type, 36 x 42-inch elliptical section, and are extremely economical of fuel, the mixture used being 1 of coke to 13 of iron. They are very rapid melters, and can, when required, deliver as much as 9 tons of metal per hour each.

This foundry makes all sizes of pipe from 4 inch. to 24 inches diameter, sizes larger than this being manufactured at the company's plant at Three Rivers, Que. The iron flasks have trunnnions supported in small carriages which run on two rails in the moulding pits. Four-inch flasks are grouped six to a carriage; six and eight-inch flasks, four to a carriage; and all sizes over eight-inch, two to a carriage. In each pit there runs a long-link endless chain, with which the carriages can be engaged by a hook; in this way the moulds are moved down one side of the pit and up the other, thus going through a continuous cycle of operations. The approximate position of the flasks during ramming is indicated at A in the illustration on page 263. All pipes up to 20-inch are moulded bell end up, the main portion of the pattern being first inserted in the flask by the electric jib crane seen at F. The mold is then hand-rammed, after which the bell pattern is inserted and rammed. The bell pattern is then removed and the main pattern drawn. A man at the bottom of the pit now knocks out the door wedge and drops the cone pattern. A plunger of the same size as the bore of the pipe is next inserted in the mold, and a bucket of blacking is poured in on top, after which the plunger is pushed to the bottom of the mold by a long rod. In this way an even coat of blacking is distributed over the face of the mold. The latter is now ready to be dried and to this end the hook on the carriage is engaged with the endless chain and the mold drawn to the far end of the pit. Here, a transfer table brings it in line with the entrance to the oven, into which it is pushed by an electrically operated ram.

THE WHEEL FOUNDRY.

THE CHARGING PLATFORM.

The oven, of reinforced concrete, 75 feet long, and heated by five coke fires equally spaced, is seen in the illustration; the molds emerging from the door marked (B). The core is now lowered by one of the overhead cranes, a chill ring inserted in the bell mouth, and a covering plate put on. The mold is then inverted on its trunnions and the core centred at the spigot end by means of three set screws and centreing clamps. The molds are next drawn by endless chain to the upper end of the pit—seen in the illustration, and a second transfer table returns them to the leg of the pit from which they started, where they are poured. A group of molds ready for pouring is seen at (G). The mold is

next reversed, the cover plate and chill ring removed, and the overhead crane drops a long hooked rod right through the pipe. A triangular link is then dropped over the hook by which the crane pulls the pipe from the mold, afterwards placing it at the entrance to the pipe cleaning department as seen at (H). The flask now passes on to the position shown by letter (D). Here the dry sand is shaken out, and falls through a grating in the bottom of the pit, from which it is carried by an enclosed bucket elevator (E) to a horizontal conveyor, and thence to the mixers, to be prepared for further use. Meanwhile, the mold has gone forward to the position indicated by (A) and is again rammed up as before.

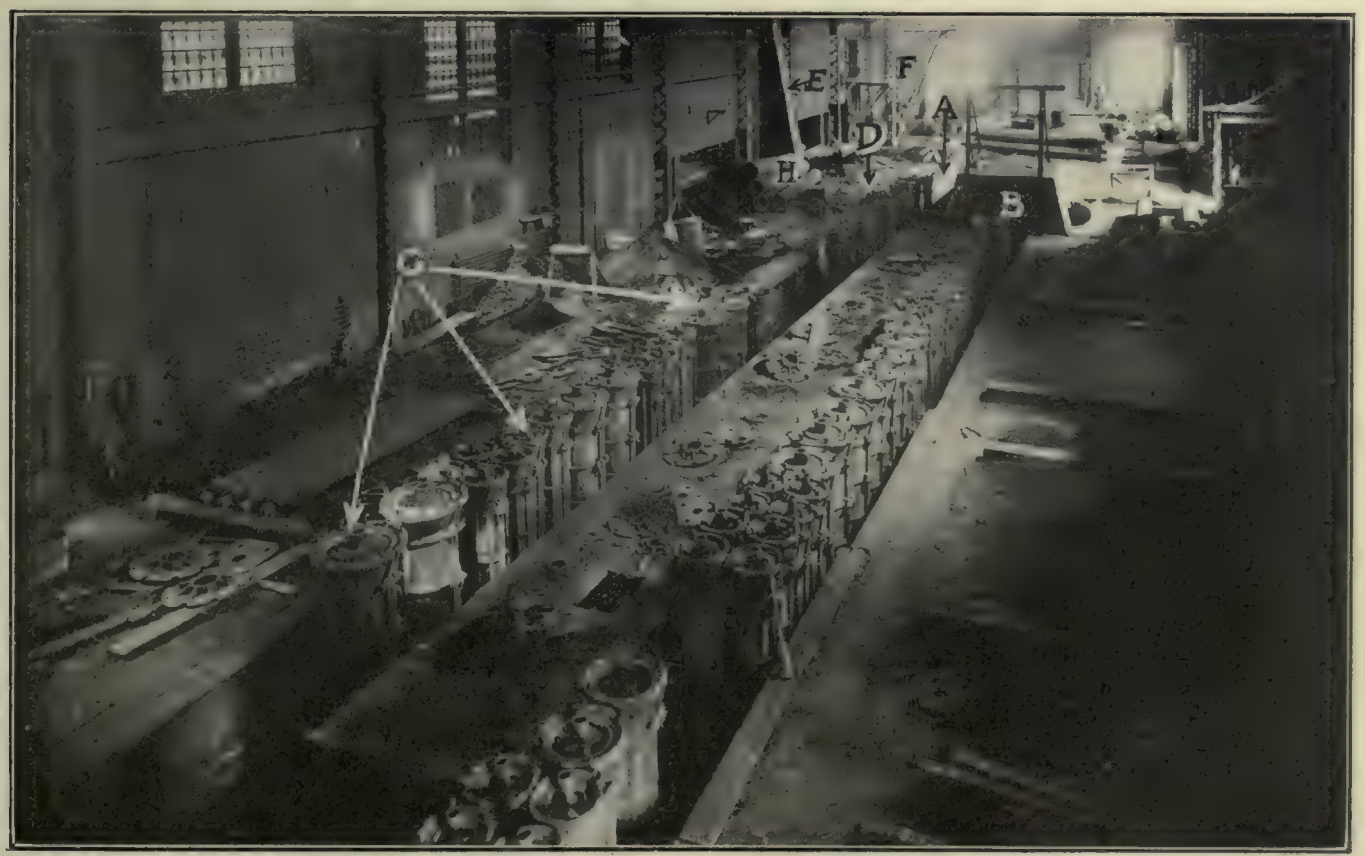
In the case of 24-inch pipe, the mold is rammed bell end down, and of course is also cast in this position, as is all pipe. In making the mold, the body portion of the pattern is first drawn. The flask is then raised, leaving the bell pattern behind. A socket core is next made separate on a plate, and the mold, after drying, is closed over the socket. The main core is now lowered into the mold to where it fits into the socket core, and is centred at the upper (spigot) end in the usual way. The mold is then ready for casting.

Loam for the pipe cores is obtained from a clay pit on the premises, and is brought to the core room by an industrial track. Two mud mills grind it up, one working on first coat and one on second coat mud. In making the cores, much labor is saved by the use of a 7 h.p. motor for revolving the core bars. The hay rope is all made on the premises, the hay being first damped in a wooden chamber fitted with steam jets, after which it passes to two hay-rope twisting machines. The core rooms are equipped with three 2½ ton travelers and contain twelve coke-fired core ovens.

PIPE CLEANING DEPARTMENT.

**Pipe-Cleaning Dept.**

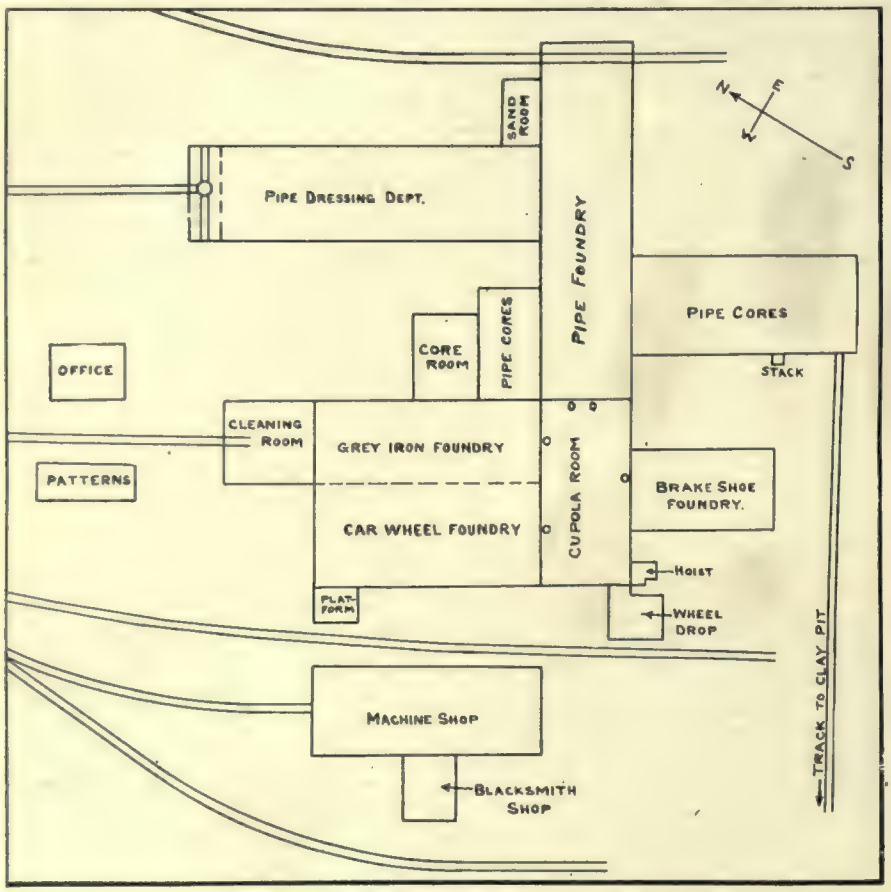
An illustration of this department is given on this page. The pipes are rolled in from the foundry on elevated rails and first of all have the remains of the core removed. This is accomplished by two special chain cleaners patented by Mr. C. L. Job, assistant manager of foundries to the Canada Iron Corporation. A chain is passed through the hole left by the withdrawal of the core bar, and is passed over two pulleys one at either end of the pipe. The two ends of the chain are then coupled by a hook and link. The pulleys are rapidly revolved from a motor driven countershaft and the flying chain quickly removes the hardened core. The two




INTERIOR OF THE PIPE FOUNDRY.

wooden A-frames, seen in the middle of the cleaning room, carry the idler pulleys, the driving pulleys being seen on either side against the walls. The A-frames are fitted with an adjusting device for increasing or decreasing the sag of the chain to suit varying diameters of pipe.

After having been cleaned, the pipes are rolled forward to the cutting off lathe, seen in the illustration. They are here reduced to standard length, several inches being cut off the spigot end, thus getting rid of the dirty metal that will have risen to the top of the mold. The pipes are removed from the cut-off lathe by the electric traveler seen overhead, and are rolled forward on the rails to a wood-fired heater, and then dipped in the tar vat. The next process is testing the pipes. For this purpose, there are two hydraulic testing machines by which a standard pressure of 300 lbs. per sq. inch is applied to each pipe. In special cases, the pressure can be increased to as high as 450 lbs. The testing machines are operated by an accumulator having an 8-inch ram and 9 ft. stroke. Having been tested, the pipe passes to a platform scale, and is then marked for weight and inspected, thereafter going to the stockyard.




PLAN OF WORKS.

**Machine Shop, Power House, Etc.**

There is a thoroughly well-equipped machine shop in connection with the plant. This building measures 137 ft. by 60 ft., and is used for general jobbing work, as well as for boring car wheels, making up pipe flasks, etc., etc. The shop is served by a 20-ton traveler and has a 150-ton hydraulic press for forcing car wheels upon their axles. The machine tools are all of up-to-date design and include a 56-in. boring mill; 72 in. radial drill; No. 2 milling machine; 36 in. gap lathe; 36 in. by 18 ft. shafting lathe; 18 in. slotter; 36 in. planer, etc., etc. In one corner of the shop there is an Ingersoll-Sargent motor driven air compressor which supplies power for the pneumatic tools in the different dressing departments, and for scrap breakers, elevators, etc. In an annex on the west side is located a small blacksmith department.

The power house is a small building situated some distance from the main plant and not seen in the plan on this page. It contains 2 Allis-Chalmers-Bullock motor generator sets, to operate which, 3-phase current at 2,200 volts, 60 cycles, is purchased from the Kaministiquia Power Co., Ltd. Each motor is direct coupled to its generator, and the latter has a capacity of 75 k.w., delivering direct current at 230 volts.

**Other Plants of the C.I.C.**

In addition to the Fort William foundries, the Canada Iron Corporation have five other plants. At Londonderry, N. S., they have a pipe foundry and steel foundry; at Three Rivers, Que., a grey iron foundry, pipe foundry and machine shop; at St. Thomas and Hamilton, Ont., they manufacture car wheels, brake shoes and general castings; and at Midland, Ont., they have blast furnaces, grey iron foundry and machine shop.

We are indebted to Mr. D. W. Davies, local superintendent at Fort William, for facilities granted for the preparation of this article on the occasion of a recent visit.

## ANCIENT IRON.

SIR ROBERT HADFIELD has been able to obtain some specimens of the metal of the famous iron pillar at Delhi, and analysis shows the following composition: — Carbon, 0.08; silicon, 0.046; sulphur, 0.006; phosphorous, 0.114; iron, 99.72; total, 99.966. The iron percentage was determined, not taken by difference. The material is thus an excellent type of wrought iron, and the lowness of the sulphur percentage indicates that the fuel used in its manufacture and treatment, probably charcoal, must have been very pure. The metal contains no manganese which is remarkable, since that element is usually present in wrought iron. Sir Robert believes that this is the first time a complete analysis has been given of the material composing the Delhi Pillar. The specific gravity of the metal is 7.81.

## INDUSTRIAL ACCIDENTS.

DURING the month of July there were 108 fatal and 272 non-fatal accidents recorded by the Department of Labor. This is an increase of 46 fatal and 38 non-fatal accidents compared with the record for June, and an increase of 10 fatal and 73 non-fatal accidents compared with July, 1911. Accidents recorded in which more than 2 workmen were killed, were, one as the result of a falling derrick at Kenogami, Que., on July 1, by which 7 men were killed; one by which 4 railway construction hands were killed by a premature explosion of dynamite on July 23, near Moberly, Ont.; one at Kenogami on July 25, by which four men were killed as the result of an explosion in a factory at Windsor Mills, Que., on July 8. Two workmen were electrocuted as the result of a falling pile driver coming in contact with live wires at Meaford, Ont., on July 18.

## HYDRAULIC RIVETING*

By H. J. Hartley.

CONSIDERABLE diversity of opinion seems to exist regarding pressure per square inch of rivet section required for all classes of boiler work. At the present time the importance of having rivets to completely fill the holes is more fully realized and insisted upon than was the case twenty years ago. Under the old system of hand riveting, with the holes much too large for the size of rivets to be driven, doubtless much imperfect work was made. It was, and still is, a fruitful source of disaster, as rivets with loose fitting bodies, in addition to being imperfect themselves, allow undue weakness in the plates, owing to unequal and incomplete bearing surfaces. Hence, the strongest joint has been found by experiment to be that in which the area of the rivet body exceeds the net sectional area of the plate; the increased friction on the bearing surfaces and grip of the rivet heads on the plates more than compensating for the reduced plate area.

When riveted joints are being formed, the tendency is for the rivet to be upset on the end where the final head is being formed; the friction in the rivet hole resisting its flow to some extent. It is conducive to tight work to have a fillet under the head of the rivet which will, wedge-like, jam into the slightly countersunk hole; thus insuring, at least without the necessity of caulking, a watertight rivet, provided the plates composing the joint have been properly fitted and the rivet holes made fair and of proper size. The allowance, on increased sizes of rivet holes for heat expansion over the sizes of the rivets to be driven in first-class high-pressure boiler work, should not exceed the following fractional numerals, namely:—For ¾-in. rivets make hole 1-32-in larger; for ⅞-in., 1 in. and 1⅛-in. rivets make holes 3-64 in. larger; for 1¼-in., 1⅜-in. and 1½-in. rivets make holes 1-16 in. larger, and so on proportionately. All rivets should be heated to a medium cherry red at the head, and, if possible, to a dark cherry red at the points.

### Cold Rivets for Tank Work.

With regard to the pressures required for driving rivets cold in tank and stack work, I would recall some experiments made by Wm. Sellers & Co., between the compression platforms of their Emery testing machine. A number of ⅜-inch size rivets were subject to pressures between 10,000 and 60,000 pounds with the following results:

At 10,000 pounds the rivet swelled and filled the hole; at 20,000 pounds the head was well formed; at 30,000 pounds the rivet was well upset and headed; and at 40,000 pounds the metal plates surrounding the rivets began to stretch. This became more pronounced as the pressure was increased to 60,000 lbs. From these experiments, the conclusion might be drawn that the pressure required for driving and heading cold rivets is about 150 tons—300,000 pounds per square inch of rivet section.

### Rivets for High-Pressure Boilers.

A series of tests to determine pressures for driving rivets in high-pressure steam boilers was made about the same time at the Baldwin Locomotive Works, by Mr. Vauclain, with the following results:

Six sets of 9-16-inch plates were selected and prepared for the tests, each set being composed of six plates, these being drilled for rivets varying in size by one-eight, from ⅝-inch to 1¼ inches in diameter. In the first set, the ⅝-inch

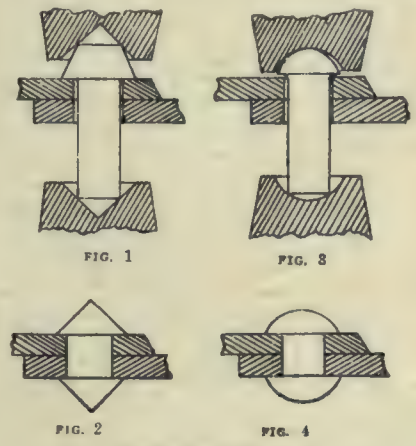


FIG. 1 FIG. 3

FIG. 2 FIG. 4

Hydraulic Riveting.

rivets were driven with a pressure of 25 tons; in the second set, the ¾-inch rivets were driven with a pressure of 33 tons; in the third set, the ⅞-inch rivets were driven with a pressure of 50 tons; in the fourth set, the 1-inch rivets were driven with a pressure of 66 tons; in the fifth set, the 1⅛-inch rivets were driven with a pressure of 75 tons; and in the sixth set, the 1¼-inch rivets were driven with a pressure of 100 tons.

The specimens when cut in half longitudinally through the rivet showed that where a pressure of 33 tons had been applied, the metal under and around the heads of the ⅝-inch rivets was indented or compressed. When 50 tons on both the ⅝-inch and ¾-inch had been applied, the same effect was noted, and so on up to 100 tons pressure.

In a second test similarly conducted, the rivet holes were punched instead of drilled; the only difference in the result being that the plates showed no indentation and the holes were all filled. The conclusion was that the suitable static pressure for ⅝-inch rivets is 25 tons; for ¾-inch rivets, 33 tons; for ⅞-inch rivets, 50 tons; for 1-inch rivets, 66 tons; for 1⅛-inch rivets, 75 tons, and for 1¼-inch rivets, 100 tons. Converted into pressure per square inch of rivet section, the figures in even pounds, would be approximately as follows:

| Diameter of Rivets. | Pressure per Square Inch in Pounds. |
|---|---|
| ⅝ inch | 163,000 |
| ¾ inch | 149,000 |
| ⅞ inch | 166,200 |
| 1 inch | 168,000 |
| 1⅛ inches | 151,000 |
| 1¼ inches | 163,000 |
| Average | 160,000 |

**Example**—Static pressure, 25 tons= 50,000 pounds, divided by area of ⅝-inch rivet=.3680=162,952 pounds pressure per square inch of rivet section. The average of the above pressures per square inch of rivet section is 160,000 pounds, which may be used in calculating the necessary pressures for rivets of other sizes. An experiment was also made in cold riveting, thus: A pair of plates were punched for ¾-inch rivets, which were driven into the holes with the same range of pressure, but it was found that the lower pressures were not sufficient to form the head, whereas the higher ones indented the plates. The writer has been working under the foregoing described conditions with the same riveting plant for about twenty years, doing all classes of steam-boiler work, varying in thickness of plate from ⅜ inch to 1¾ inches, and in rivet diameter from ⅝ inch to 1½ inches, with perfect success.

### Terminal Impact of Ram.

There exists a condition, however, connected with hydraulic riveting, that is especially favorable to rivet compression and the making of tight work, which is generally not known or realized. It is due to an increased pressure at the terminal stroke of the ram over the initial stroke, amounting by experiment to be conditionally as high as 60 per cent. In other words, a static pressure of 1,200 pounds per square inch in an accummulator has shown on the gauge at the end of the stroke a momentary impact of 2,000 pounds per square inch. It will be understood that this increased terminal pressure is due to the surge of the accummulator on its sudden arrest at the end of the stroke and at the time when the rivet has become cooled from contact with the water-cooled dies and plates. Too much value cannot be given to this terminal pressure as a climax to perfection in hydraulic riveting; the effect being about the same as that of a second pressure on the rivet after partially cooling. This advantage is ever there and costs nothing to obtain, being altogether unlike the extra labor required

*Abstract of paper read recently before the American Boiler Manufacturers' Association.

on hand and pneumatic riveting to accomplish the same object—tightness, by having to partly drive a rivet and shift to the next in order to allow the first to cool; partly drive the second, shift back to the first and finish it, then go again to the last left unfinished, and so on throughout.

In order, however, to obtain the full value of the terminal pressure, it is necessary for the operator to exercise some skill in admitting the initial pressure to the ram. This is done by opening the valve slowly and sufficiently until the hot rivet has been well upset into the hole, after which the full pressure is applied. This will have the effect of accelerating the descending momentum of the accummulator, thereby causing a suddenly increased pressure on the rivet at the moment of its impact and the rebound, due to cushioning on account of more or less air in the water. This is more apparent with accummulators having small areas of pistons.

### Shapes of Rivet Heads.

The accompanying illustrations will show the shapes of the rivet-beads generally in use by most boiler manufacturers.

Fig. 1 shows the shape of rivet-head mostly used by manufacturers. It also shows a rivet with pan-shaped head, ready to be driven with cone-shaped dies. The rivet being hot and the initial pressure bearing on the head and point, it necessarily follows that the rivet must flow into the dies before it gets bearing sufficient to squeeze it into the hole; the initial pressure being utilized in filling the dies.

Fig. 2 represents the shape of the rivet-heads after being driven.

Fig. 3 represents a rivet with round-shaped head, having fillet under head, heated and ready to be driven. It will be noticed that the dies on head and point bear more centrally; and while the die at the blank end of the rivet has a slight point bearing like Fig. 1, yet it is so little, due to the head end being solidily and firmly held in the die, that it may be said the initial pressure is bearing centrally on both ends of the rivet, thus permitting it to flow into the hole while filling the radial-shaped dies. In other words, the main feature is accomplished by the rivet filling the hole before the head is formed.

Fig. 4 represents a rivet driven with round-shaped dies in comparison with Fig. 2—cone-shaped dies.

Figs 2 and 4 show relative values of the two shaped heads, each having the same quantity of material. The round head is seen to be the better and also the stronger in the shearing section of the head. It is much easier to caulk a round-head than a cone-head rivet, if such should ever be required. The first indentation of the caulking tool on a round-head rivet forms an arch or backing to the tool, which has the effect of forcing the metal down to the plate, similar to caulking the edge of a seam, while the same operation on a pan and cone-shaped head has a tendency to curl up the thin edges of the rivet on account of insufficient metal above the caulking surface.

## EMPLOYERS AND EMPLOYEES.

OF increasingly interesting value to the business world to-day is any feasible means of bettering the relationship between capital and labor. In the July issue of The Organizer, W. J. Chinneck has an excellent article on the fair treatment of employees by employers, in the course of which these suggestions appear:—

"Now that employers are beginning to realize that it pays to treat their workers honestly, just as it pays to treat their customers honestly, they are beginning to wonder how to do it. Fortunately, they have not far to seek. They have the example of a few wise men who thought this matter out years ago, and have evolved various schemes by which they and their employees are working for the success of the business which provides for them, instead of using up mental force in scheming to get the better of each other.

### Full Co-partnership.

There is one scheme above all others which stands out as the best, if only it can be worked, and that is full co-partnership. Co-partnership is as far beyond profit-sharing as the latter is beyond no scheme at all, and to-day we are hearing a great deal about co-partnership. It is being advocated by politicians and by business men, but the meaning of co-partnership is not at all clear in the minds of a number of people, there being many different forms and many different degrees to co-partnership. It is as well to emphasize that co-partnership does not mean that payment for work done is made partly in cash and partly in shares or in kind. Payment should be entirely in cash, and the workers, or at least a large portion of them, being actual partners in the concern, should receive a dividend as shareholders in addition to full wages as workmen.

In the fullest sense of the word co-partnership also means that one partner should have just as clear a title to his invested capital as another partner, although the practicability of this does not always commend itself to the employer. It is exceedingly difficult in the case of a private firm or a private company to make such an arrangement as has been indicated. A workman having become a partner may leave and go to a rival firm, in which event it would clearly be desirable to regain possession of his shares on behalf of the other employees. In the case, however, of public companies, the value of whose shares is generally quoted, the adoption of full co-partnership is much simplified, because the capital is split up conveniently into units, and there are always a number of shareholders who are ready to sell at a price which the market itself fixes, and which is presumably a fair price.

### Profit-sharing in Practice.

The plan adopted by one or two large public companies is that a certain share of the profits after paying dividends at an agreed rate, shall be distributed amongst the employees. This is the worker's share of the profit, and in order that they may become partners, it is necessary that they should apply the whole or a certain part of this bonus to the purchase of shares. It has sometimes been objected that employers make it obligatory that at least a portion of this profit should be applicable only to the purchase of shares, but it will be seen that unless this is done the scheme is not co-partnership, but profit-sharing. In order to get co-partnership you must provide for a proprietary interest, and the whole principle of co-partnership is to make the interests of the worker identical with those of other stock holders.

If a man wishes to take his bonus and not apply for shares he is not looked upon as the most desirable type of employee. In practice it is found to work out that the great majority of the employees want to buy shares. I was informed by a large employer, who has an arrangement whereby only half of the bonus need be applied towards the purchase of shares, that 90 per cent. was actually used by the men to increase their holdings. The acquisition of the shares is, of course, a simple matter when they are quoted on the market. They are bought at their value by an official on behalf of the employees, and are then held by the latter, who, in future, receive the dividends payable thereon in addition to the share of the profits which still goes to them each year as employees.

### Encouragement to Thrift.

It will readily be seen that if the company is prospering, as profit-sharing companies generally do, the worker is adding every year to his capital, and gradually acquires a very respectable holding. The plan has been found to have a very great moral effect on the workers, and the man who previously

never dreamed of ever having property worth more than a few dollars gradually begins to see the value of thrift; and, in addition to the shares which he acquires more or less automatically, it frequently induces him to put aside a share of his wages, which is also used to increase his stock holding.

I have heard that Sir George Livesey, before he started co-partnership, went down to South Wales in connection with a local strike. He saw a man still working on a small locomotive in the docks and said, "And why are you not on strike?" The man replied, "I am a shareholder in the concern. Pretty foolish I should look to be striking against myself." This undoubtedly sums up the attitude of the workers where co-partnership has been in operation.

**Co-partnership Mutually Beneficial.**

Provided a fair day's wage is paid in the first place—and that is always contemplated by co-partnership—it makes the interests of everyone concerned identical. It means that the men are going to think for the business, and are going to be in favor of anything which makes for the prosperity of the business. From this point it is easy to get the co-operation of the men in effecting savings and in working honestly. It makes a man anxious that his mate should work as hard as he does, rather than he should not work harder than his mate. Under some schemes employees have the right to appoint representatives from amongst themselves to the board of directors, and this leads not only to co-operation but to good counsel, since, it is a means by which employers and their workers are led to understand each other's difficulties."

## ELECTRIC BLOWERS ON BLACKSMITH'S HEARTHS.

AS a considerable number of blacksmith's hearths are now fitted with blast provided by electric blowers, states the Electrical Review, the following incident may be of interest. In one case where a blast was obtained by an electrically driven fan, the delivery pipe was surrounded by a water jacket on account of the heat, and it was found that the temperature of this water rose practically to boiling point when the fan had been in operation for some time. On one occasion it was discovered that the draught was gradually getting weaker until it almost failed altogether. Suspicion was first of all thrown on the electrical portion of the gear, but this was found to be perfectly in order. The fan was taken adrift and the impellers and all parts of the casing were found to be in good condition.

On taking apart the ducts, however, it was found that the delivery pipe was burned through, which accounted for the loss of draught. This burning action was in its turn explained by the fact that owing to the heating of the water, rapid evaporation set in, and the level of the water fell below the level of the effective portion of the delivery pipe without its being noticed, with the result that the pipe was exposed to the full temperature of the escaping gases without any cooling action taking place.

A new pipe was fitted, and instead of the water in the surrounding jacket being poured in by hand at intervals as had previously been done, the water pipe was fitted with a ball cock, set so that when the water in the jacket got lower than was advisable, the cock was opened and allowed more to flow into the tank. This simple alteration prevented further trouble.

## LOCOMOTIVE BOILER TESTS.

TWO low-water tests were carried out recently on locomotive boilers, one equipped with a Jacobs-Shupert sectional firebox and the other having the ordinary form of radial stay construction. In the radial stay type the flat side and crown and wrapper sheets are connected by radial stay-bolts, while in the Jacobs-Shupert type the flat plates are replaced by a series of corrugated channel-form sections riveted together with the flanges turned from the fire. Stay-plates or diaphragms are used instead of stay-bolts, and the rivets connecting the sections together serve also to connect the sections to the stay-plates.

In making the tests, which were carried out by the Jacobs-Shupert U.S. Firebox Company at Coatesville, Pa., two full-size locomotive boilers designed for high-speed passenger service were used, identical in size and design except that one had a sectional firebox while the other had one of the ordinary radial stay type. Both boilers were mounted in a field 50ft. apart, and were operated from a shelter 200 ft. from the nearer boiler. Oil was used for fuel, because of the danger to which a fireman shovelling coal would have been exposed. In the process of testing, each boiler was brought to a condition of operation closely approaching a maximum power of 1,400 h.p., which is equivalent to that required to haul a heavy passenger train at a speed of 60 miles an hour. The supply of feed water was then shut off, all other conditions remaining unchanged, and the water level gradually fell and exposed the crown sheet and other portions of the heating surface to the full effect of the fire. The boiler having the sectional firebox was tested continuously under these severe conditions for 55 minutes without developing any failure, although the water level fell to a point more than 25 in. below the crown sheet. The test was then discontinued because the small supply of water which remained did not evaporate fast enough to supply the necessary draught to maintain the fire. At the conclusion of the test the firebox of this boiler was apparently in good condition and ready for further service.

The ordinary radial stay boiler was then tested under identical conditions, and after the test had been in progress for 23 minutes, and the water level had fallen to 14½ in. below the crown sheet, an explosion occurred. The crown sheet, and the stays which held it in place became highly heated and pulled away from each other, with the consequence that the pressure in the boiler was released. The discharge of steam was through the firebox, and the force was sufficient to throw parts of the furnace in all directions and to lift the entire boiler, which weighed 40 tons, several feet above its foundations. The damage was such as to necessitate the reconstruction of the boiler.

The boiler having the Jacobs-Shupert sectional firebox carried between 215 lbs. and 225 lbs. for the first 27 minutes, and the pressure gradually dropped thereafter until it reached 50 lbs., at the end of the test. The steam pressure on the radial boiler varied between 220 lbs. and 230 lbs., and it was 228 lbs. when failure occurred. The gauges and the water level in the gauge glass were read by telescopes.

## WELDED PIPES.

IN a recent discussion on welded pipes before the American Society of Mechanical Engineers, the fact was brought out that in commercial welded pipes the variations in thickness of wall, perfection of weld and other features of manufacturing, give rise to variations in the bursting strength which are of sufficient magnitude to render unnecessary any great refinement in the use of formulae. Relative strengths of steel pipes and tubes were indicated to be as follows:—For butt-welded steel pipe, 73 per cent.; for lap-welded steel pipe, 92 per cent.; and for seamless steel pipe, 100 per cent. In steel pipe the strength of the butt-weld appears to be about 80 per cent. of that of the lap-weld.

The relative strengths of wrought iron and steel pipe appear to be as follows:—Butt-welded wrought iron pipe is 70 per cent. as strong as similar butt-welded steel pipe; lap-welded wrought iron pipe is 57 per cent. as strong as similar lap-welded steel pipe.

# Birth and Development of the Steel Works Engineer*

By A. L. Hoerr

*The writer deals in an attractive manner with the rise to his present highly-respected position of the once more or less despised steel works chief enginer. The "Practical Men" used formerly to turn up their noses at the technically trained engineer and his staff of draftsmen; but that state of affairs is now a thing of the past. The paper incidentally gives many useful hints as to the economical operation of a rolling mill.*

THE writer's experience began at a time when the rolling of steel was done to a large extent on mills that had been designed to roll iron, and were, therefore, not suited to the new requirements. Even newer mills, designed for the service, were often inadequate, partly because of the inexperience of the designers and partly because the demands of the business grew so rapidly that the mills could not be kept in line with them. The constant demand was for tonnage. Day by day this demand grew and the mills had to satisfy it. New and larger sizes of standard shapes were added to the rolling schedules as well as entirely new shapes; and as a result of these conditions, breakdowns were very frequent.

### The Old Time Mechanics.

The men in demand were the master mechanics and their millwrights. Having been trained only in the hard school of experience, they knew little of books or calculations. Time in many cases could not be taken to determine the exact cause of a break, and the only remedy applicable was to make the new part stronger than the old. That this might and often did cause breakage in some other part of the mill or machine, could not be foretold, the main point being to get things going again as quickly as possible.

Foundations for new buildings or extensions, for shears, tables and other machinery were located in the field by means of a carpenters' chalk line, a straight edge, and a spirit level. The new building was planned about parallel to some existing building or track, but seldom with any thought of what might be needed in the near future.

Much of the machinery was designed in the pattern shop, and drawn full size on large built-up boards. Pattern-makers and machinists worked to these drawings and when the job was completed the drawing was erased with a plane and everything was ready for the designer once more. Repair parts were obtained by having someone who remembered the job, visit the pattern storage house and by the aid of some mysterious sense of direction, pick out the pattern. The machinist went to the broken or worn out parts for his sizes and very frequently got them right.

### Improved Methods Evolved.

The mechanical men of that period deserve great credit for the work they did for the steel mills. Without engineering education or elaborate mechanical equipment, they designed and built the plants that earned the money to pay for the successive steps to our present efficient installations.

As larger mills were built, with elaborate mechanical mill tables, shear tables and cooling beds, the need of a more orderly system of working became apparent. In some cases, the master mechanic arose to the occasion and changed his methods, becoming, in fact, the engineer. In most cases, however, he leaned more and more heavily on the once despised draughtsman. The mechanical men could no longer take time to pick out the patterns, for there was other and more important work for them to do. The number of units in the plant had grown greatly, with a corresponding increase in the number of spare parts previously carried, and accurate drawings became a necessity. There had always been a few draughtsmen stuck in some dark corner of the plant, but they were not counted as of much importance. They were usually referred to in rather disrespectful language by the mechanical men, and if the truth be told, they often deserved it. The new conditions made necessary the employment of a large force of draughtsmen and also the organization of a field force to survey the ground, lay out the foundations for buildings and machinery, and supervise all construction.

The engineer, with this organization under his control, became a man of greater importance in the plant. He was called on to assist in many ways in the systematizing of numerous plant operations, beginning with a proper marking of his own drawings, and extending through the pattern shop into the foundries, machine shops and other finishing departments. Men from his department were detailed to follow the orders through the shops, expediting the transfers from one shop to another, interpreting drawings and making such changes as the development of the work made necessary. He could no longer be the designer of machinery for someone else to build, but on the contrary he must study carefully all of the processes involved and adapt his design to the facilities available.

In the field all locations for buildings and machinery were now carefully selected with regard to the future and many surveys and studies were made before excavations were started. In order that operations at widely separated points should have a definitely known relation to each other, standard base lines and elevations were established from which all surveys started. In many places the power end of the plant engineering grew up as a department distinct from the general engineering, while in other places they grew up together. In any case the problems were unchanged.

### Power Plant Equipment.

The old equipment usually consisted of tubular boilers, simple, non-condensing engines and simple direct acting pumps. The electric power house was almost unknown except for a few belted arc machines. The boilers were all hand-fired and the ashes were taken out in wheelbarrows or carts. Coal was cheap and nobody objected to the smoke, which was accepted as the one best sign of prosperity. Into the midst of these conditions the engineer was projected in the course of his progress through the plant. The demand was not so much for changes which would save fuel as it was for changes that would make it possible to pull the loads with the existing engines and to get from the boilers enough steam to enable them to do it continuously. To meet this demand it was necessary to systematize the operations in the steam department. The firing of coal, cleaning of fires and blowing down the boilers in the various groups, were all arranged so as to interfere as little as possible with the production of a regular supply of steam both as to quantity and pressure. The boilers were cleaned more regularly and more thoroughly, and were carefully ex-

*Abstract of paper read recently before the Western Pennsylvania Engineers Society.

amined for both steam and water leaks. Steam pipe systems which had grown with the works and had been extended in all directions without any calculation as to pressure drop, were reconstructed so as to give shorter runs to the various consuming points, thereby making available a higher average steam pressure. This, together with the adjustment of valves so as to balance the work in the cylinders and reduce the back pressure, gave a new lease of life to many engines, apparently antiquated.

**Introduction of Stokers.**

As additions to the plant were made, water tube boilers and automatic stokers were introduced, sometimes with the mechanical ash handling machinery, frequently without. Compound engines were adopted with much hesitation at first, and in many cases were operated for years without condensers. Later, condensers were added, and until the advent of the low pressure turbine this was considered the most economical steam using combination possible. Some engineers maintain that this is still true.

The power plant grew greatly in size as motors replaced engines for driving the smaller auxiliaries in the plant, including the driving of shops, cranes, mill shears and tables, and the problem of the economical generation and transmission of electric power became of prime importance.

The reciprocating steam engine had this field to itself for a long time; but the high pressure turbine, the large gas engine using blast furnace gas and the low pressure turbine, have entered the field, in the order named, and are making strong bids for favorable consideration. Each, no doubt has its place, it being the engineers' duty to determine when and where they can be used to the best advantage.

Economizers and superheaters for the steam plant have been used rather sparingly; but the tendency now is to figure on them very generally, especially in connection with the utilization of waste heat from various metallurgical operations.

**Engineer and the Power Plant.**

In the plants where these various fuel saving devices were installed, it was quickly learned that their efficiency could only be maintained through constant and watchful supervision. It was not sufficient to instal a feed water heater; it was necessary to learn the water temperature from day to day. It was not sufficient to instal a compound condensing engine, it was necessary to indicate it at intervals to see that the load was properly distributed between the cylinders and that the condenser was maintaining a minimum back pressure on the low pressure piston. All other equipment required similar watching to see that its original economical operation was maintained. In some cases, as previously mentioned, the master mechanic assumed this new work and carried it on successfully, but in most cases it passed to the engineer. As there was no important part of the works that did not use steam, water or electricity, and as the engineer was now largely responsible for their economical production and distribution, there was no important phase of the plant's operation with which he was not brought in close contact. Although still looked upon by the so-called practical man as somewhat of a dreamer, he had an established place in the plant and was doing a work which became of more importance every day.

To-day the power problem is being given careful and detailed consideration in many large plants by separate engineering departments, organized for the purpose of collecting and interpreting data. These studies are of value for many purposes; among others, to determine the conditions under which most nearly continuous operation is assured; to determine the conditions for most economical operation; to aid in accurately determining costs of various products by a proper distribution of steam, water, electricity, etc. to the various departments, and to accumulate in available form, data from which the merits of proposed new equipment can be judged.

**Power Plant Records.**

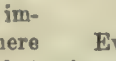
To this end records are kept of the steam and water pressures, of the condenser pressures, of the temperatures of boiler feed water and of condenser water, of the weight of coal and water supplied to the boilers, of packing and pump valve service, of lubricating costs, and in short as nearly as possible of all variables that affect the operation of the plant. The records are supplemented by records of numerous boiler, engine and pump tests made under operating conditions. All of these data are then available for study by interested parties, either to throw light on certain cost sheet items or in connection with changes in equipment.

That the engineer has reached the limit of his development in plants of this character, the writer does not believe. Many men of engineering training and experience have reached important executive positions, and there are many reasons for believing that many more will do so in the future.

Expression has been given, however, more and more frequently of late, to a belief that will do much to prevent this. It has appeared in the engineering press and is frequently heard in the conversation of engineers. It is to the effect that the engineering profession is not properly recognized; that it does not receive financial rewards commensurate with the services performed, and that it does not receive the recognition in civic affairs which its interests demand and which its abilities merit. Much of this matter has about it a melancholy, disheartening sound. It professes belief in a most distressing state of affairs, blames it all on someone or something outside of the engineering profession, and looks for relief through some mysterious awakening of the other fellow which will enable him to see the engineer as the engineer now sees himself.

In the writer's opinion there is very little reason for such expressions and the instances in which conditions seem to be as represented, are almost entirely the fault of the engineers themselves. Financial rewards come to those who have for sale that which is in demand. It is not sufficient that a man be familiar with the laws of physics and mechanics or be able to calculate stresses in structures or solve problems in thermo-dynamics. Such knowledge is necessary for the engineer, but he may have it all and still be a mere calculating machine, differing from others only in height, weight or in the color of his hair. In an age when technical education is so easily obtained such knowledge alone cannot win large rewards. It is very easy to get men who can solve problems in mathematics and mechanics given the necessary data; but it is very difficult to get men who can assemble the data in proper form from the work in hand. It is easy to get men who can use steam tables and indicator diagrams in the solution of a power problem, but it is very difficult to get men who can see this power problem in the plant conditions.

It is also easy to get men who can sit at a desk and solve complicated problems in applied mechanics, but it is difficult to get men who can go into the works or through the offices and solve the constantly recurring problems in applied human nature. As engineers we have been taught that our profession is for the purpose of subduing the forces of nature to the service of mankind, but we have not been taught, to any considerable extent, that human nature is one of the forces to be subdued.



Every draftsman should realize the importance of specializing in one particular line of work. It is imposible for him to be a really good "all round" man;—like the members of other professions, he must choose the work for which he is best adapted and specialize in it.

# Jig Mechanisms, Etc. (Additional), C.N.R. Shops, Winnipeg

By J. H. Williams *

*In last month's isue of Canadian Machinery there appeared an article on the Canadian Northern shops at Winnipeg, which gave illustrated descriptions of many interesting labor-saving devices in use there. In the present article further jigs, etc., developed in these shops are fully described.*

FOR supplementing the 2-ton hand travelers in the erecting shops, a number of jib cranes have been designed and constructed in the C.N.R. shops, Winnipeg. One of these is attached to each column in the erecting shop, as shown in Fig. 1. They are used for handling all front end work and in this way save much time that might otherwise be wasted while waiting for the traveler. These cranes have a radius of 14 feet, and are fitted with a 1-ton chain block. The boom will clear the smoke-stack of any locomotive on the adjacent pits and is also lower than the bottom of the crane runway girder, thus enabling the crane to swing partly round into the machine shop bay behind.

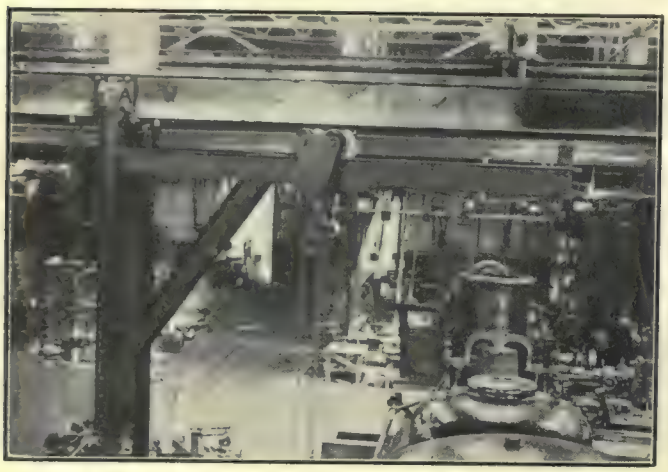


FIG. 1. ONE OF THE JIB CRANES IN ERECTING SHOP.

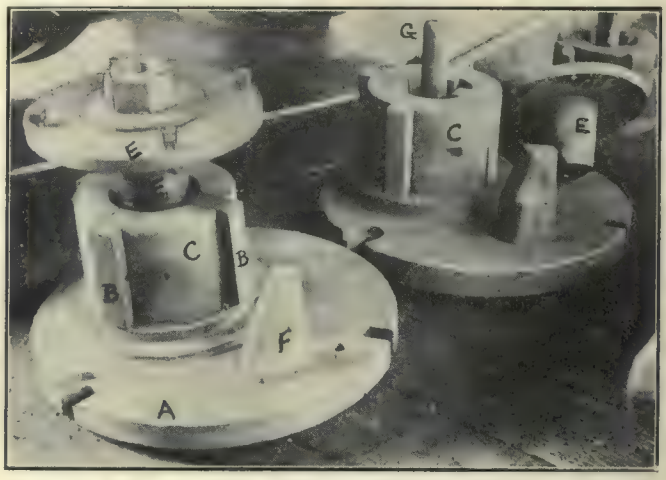



FIG. 5. JIG FOR TURNING ECCENTRIC PULLEYS.

The top pivot casting (A) is fitted with roller bearings and is bolted to the crane runway girder, while the bottom bearing (B) is fitted with a hardened washer slightly rounded on top to enable the

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FIG. 2. CRANE AND AIR HOIST FOR INDIVIDUAL MACHINES.

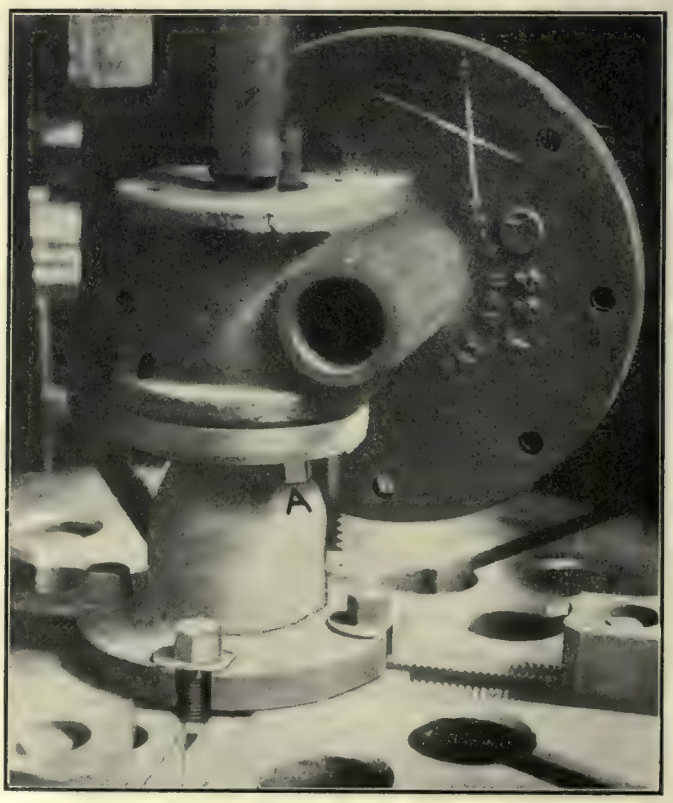



FIG. 3. JIG FOR BORING OUT VALVE BUSHING OF AIR PUMP HEAD.

crane to be swung easily. The various members are made from double channels, riveted back to back.

As stated in our August issue all the more important machines in the heavy machine shop are also fitted with jib cranes. Fig. 2 shows a 90-inch boring mill so equipped. These cranes are attached to the machine where most convenient, and carry a straight lift air hoist connected to the air line by a flexible hose. The boom of the cranes is made from 6-inch channels, while the post is of 4-inch pipe.

### Jig for Air Pump Valve Bushing.

In Fig. 3 is seen a jig for boring out the valve bushing of air pump heads. The jig has two bosses, one at each end. One of these fits the hole at the centre of the table of a Bullard boring mill, while the other fits into the valve bushing, thus keeping everything central. The work is fastened to the jig by four set screws tapped into the holes provided for the cover studs, as may be seen at (A).

### Jig for Planing Driving Boxes.

A jig for planing driving boxes two at a time is seen in Fig. 4. It is designed for repair work only, as the boxes are planed central and can thus only be planed in pairs; for instance, two main driving boxes or two trailer boxes, etc. A roughing tool in each head planes off the faces, and a special round nose tool is used for planing out the corners. The round nose tool is ground symmetrical about its vertical centre line, so that by swinging the planer head to right or left, the one tool planes both corners of the box.

### Jig for Turning Eccentrics.

The method of turning the outside of eccentrics is shown in Fig. 5. The base (A) of the jig has a boss on the underside, turned to fit the centre of a boring mill table, and thus keeps the jig central. The mandrell (C) has four slots into which are fitted four steel gripping pieces (B). The latter are turned parallel on the outside, but have their inside faces bored taper to suit the shank of the cap (E). The latter is tightened down by means of the large central bolt (G), expanding the gripping pieces (B) into the bore of the eccentric pulley. The mandrell (C) is of course out of centre with the base (A) by the amount of the eccentricity of the pulley, a different jig being used for each eccentric throw.

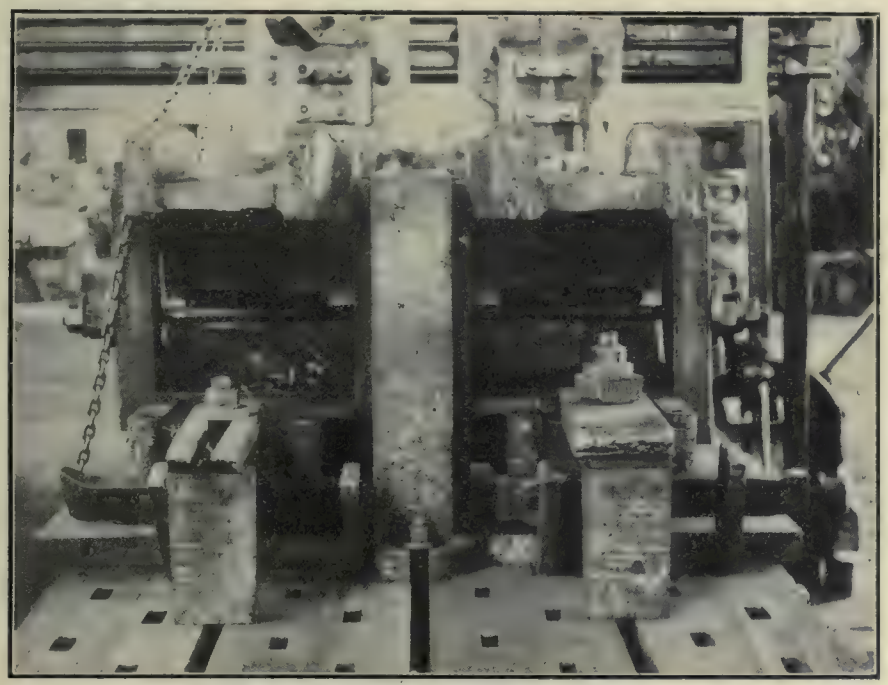


FIG. 4. PLANING TWO DRIVING BOXES AT ONCE.

On the base is a driving lug (F), placed so that the web of the eccentric bears against it and thus prevents the work from slipping under the cut.

## OPERATING COST OF ELECTRIC VEHICLES.

A NUMBER of interesting opinions on the operating cost of electric vehicles is given in a recent number of the Electrical World. For instance, the effect of proper tire equipment on the efficiency of electric vehicles is of the greatest importance. Differences of 30 to 70 per cent. in car performance have been observed between heavy tires and the best electric car rubber treads. This means that with suitable tires, an electric pleasure car may double its mileage, and the life of its battery will probably be increased in about the same proportion, provided, of course, the car receives proper attention otherwise. This question of tires alone will often account for widely different energy consumption between two customers having the same make of car and doing approximately the same work.

From reliable data covering operating expenses over a period of three years the following figures were quoted for 1-ton and 1½-ton wagons:—Average days in service per month, 24½; average miles per day per wagon, 29½; average kilowatt-hours per mile, 0.491. Car operating expense per mile:—Oil and other supplies, .6c.; general repairs, 1.4 cents; electric energy at 4 cents per kilowatt-hour, 2 cents; tires, 1.62 cents; batteries, 1.70; total expense per mile, 7.32 cents.

## NEW MATERIAL FOR HIGH-SPEED PINIONS.

THE increasing use of high-speed machinery employing a positive drive has created a demand for pinions that possess adequate strength, yet operate noiselessly. Where metal gearing is used for operating high-speed machinery, no matter how well the teeth are formed or how accurately they are cut, noise is nearly always the result. When deluged with oil, and quite new, such gearing may run quietly, but when even slightly worn, the noise created is most objectionable. This has led to the substitution of various non-metallic materials in gear trains, and for this purpose, paper and rawhide have been used with some success. It is claimed, however, for a new material named "Fabroil" that nothing approaches it either in preventing noise in gearing or in general utility.

### Fabroil Pinions.

Fabroil pinions, which are patented, are manufactured by the British Thomson-Houston Co., Rugby, England. They are formed from a special woven fabric compressed into a solid mass under several tons pressure, and held together between steel flanges either by threaded sleeves, as in the case of the small pinions, or by threaded studs, as in the case of the larger examples. The strength of these pinions is said to be greater than that of any other non-metallic pinion, and, owing to a measure of flexibility possessed by the teeth, which allows of good bearing surface across the full width of the face, they will run at high speeds without variation and absorb shocks which would be sufficient to strip the teeth of a cast iron pinion or to cause a brass pinion rapidly to lose its shape, and consequently to give trouble.

The teeth are cut to the 14½ deg. involute system, according to Brown and Sharpe's standard. After the blanks have been assembled and machined, they are impregnated with oil, and after the teeth are cut they are again impregnated with oil, which renders them self-lubricating, impervious to moisture, and able to resist atmospheric changes. They are also said to be proof against injury by vermin and insects. Fabroil also remains unchanged when heated. Machines equipped with Fabroil pinions are operating under many conditions of service, from driving a small light tool to operating heavy punch presses and shearing machines at the works of the manufacturers, who inform us that they have demonstrated their thorough reliability and have given them more severe tests to prove this than those to which pinions are ordinarily subjected, so that any weaknesses, should they exist, might be shown up. Under all tests so far given, Fabroil pinions have, so we understand, figured well, not only in comparison with other non-metallic pinions, but as compared with metal pinions. As an indication of the tooth strength of Fabroil pinions, Lewis formula using cast iron contacts will apply.

The pinions are supplied from 2-in. outside diameter, progressing by ¼-in. to 12-in. outside diameter and from 1-in. face progressing by ¼-in. up to 12-in. face.

## BELTS FOR LUMBER WORKING MACHINERY.

BELTS employed in the operation of woodworking and finishing machinery are exposed to more severe atmospheric conditions than the common belt. Ordinarily, belts are confined within apartments in mills or shops, where there is a fair protection for them; but in the lumber industry one may find belting running in the open, conveying power from an engine established in the woods to the lumber cutting machinery, also not sheltered, except, perhaps, for a crude roof thrown up over them. The belts of exterior lumber cutting service are subjected to rain, sun and dust. These three factors combine to ruin a belt in a few months, unless precautions are taken to overcome some of the troubles. There is often considerable building of sheltered passages for belts in the fixed plant; but when the sawing plant is of the portable character there is not much time or material wasted in erecting covered ways. For these reasons belts of lumber working yards are likely to have numerous defects in them.

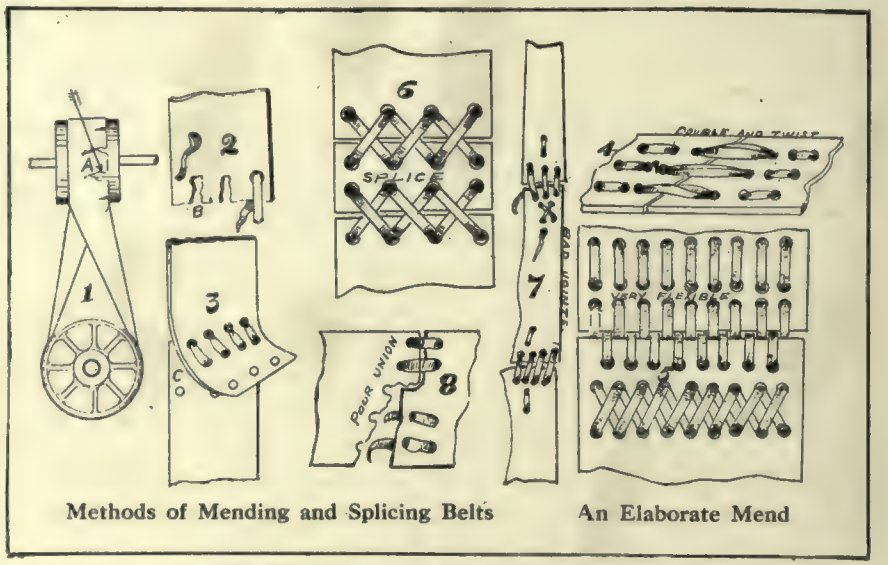
Fig. 1 shows the manner in which an exposed belt usually breaks up. The constant heating, drying, wetting and chafing of the uncovered leather results in hardening and cracking along the edge as at A. Of course, lubricants can be applied to soften the leather, and these will impregnate the fiber and help to some degree, but even the oils become non-effective as time passes and dust gathers in quantities on the surfaces. The dust hardens and is worn down to a smooth gloss on the wheels and the surfaces of the belting. When a belt gets to the stage shown, it is time to replace it, although the chances are that the new one will go to pieces in a similar way in time. In order to overcome this danger, a covered passageway should be erected.

It is becoming more common to use covered ways for running belts in lumber yards. In some cases, the portable plants are provided with adjustable sheet metal runways through which the belt may be passed when the outfit is set up. Exposed belts decay rapidly at the joints, so that in time the holes may pull out as shown at B, fig. 2. When the holes break out in this manner, the end must be clipped off to present a fresh surface. The holes, however, pull out again, and once more a piece is cut off. This takes some of the leather out each time and makes the belt shorter, necessitating a piece being spliced in. The exposed belt of the lumber yard is liable to break apart at the joints, as at C, fig. 3, because of loosening of the cementing stuffs due to moisture. In order to prevent the joint from severing entirely, a row of lacing is put in, as shown. Fig. 4 shows a triple system of lacing. Six rows of holes are punched and the centre laced with the double twist type of lacing. This distribution of laces would make a firm grip under ordinary conditions; but when a belt is in a weakened condition through moisture and general exposure the rotting leather will pull out at the holes regardless of everything.

The system of lacing shown in fig. 5 is somewhat elaborate. The workman had experienced trouble with the belt breaking at the joint. He had adopted several methods, still the laces pulled out or the ends of the belt tore off. He then devoted considerable time to the complicated belt sewing illustrated. He put a series of holes, all close together, and when he got to the middle he arranged the laces to fit alternately above and below the joint, thereby making a most pliable union.

Fig. 6 is given to show one way employed by the mechanics of a certain lumbering establishment of making a union with a splice piece inserted. It will be noticed that the crosses are confined to one side. Often in inserting a piece in a belt to make up for the bad ends that have been clipped off, the laces are made straight and crossed on the same side. This mixture of straight and crossed laces always develops trouble.

In fig. 7 is shown the kind of belt that should be avoided, for the reason that it is patched and remade in places. In case a belt has to be used after it is patched a number of times, pains should be taken to have the joints cut evenly and laced. If the splice is uniformly made, it should not hinder the run of the belt; but if the splices are poorly made, as in this figure, the belt will give endless trouble. Belts in use on struggling machines like this are sure to militate against the performance of good work. Often belts on important machinery in lumber yards operate in as bad condition as shown in Fig. 8. In case a belt thus united has much work to do, the strain will quickly tear open the union; but if the work is light the patched joint may run on indefinitely, but giving poor service.—American Lumberman.




Methods of Mending and Splicing Belts — An Elaborate Mend

BELTS FOR LUMBER WORKING MACHIN ERY.

# Machinery Display at the Canadian National Exhibition

*The annual Canadian National Exhibition at Toronto has once again come and gone and as in previous years attracted enormous crowds. The Machinery Hall once more proved far too small, and this apparently deterred some concerns from exhibiting, as several prominent engineering and supply firms were not represented.*

### EXHIBITORS.

**The Canadian Hart Wheels, Hamilton, Ont.,** showed a large selection of their Beaver brand of razor hones and corundum grinding wheels.

**The Boiler Repair and Grate Bar Co., Toronto.** were demonstrating their 20th Century shaking and dumping grate bar.

**The Jas. Morrison Brass Manufacturing Co., Toronto,** were located in the Process Building where they had a large booth in which were displayed numerous and varied specimens of the work turned out by them. The exhibit included pressure gauges, counters, injectors, marine engine-room telegraphs, etc.

**The Canada Metal Co., Toronto,** were located near the south entrance to the Machinery Hall, where they had a good display of their well-known products, including lead joints and plumbers supplies of all kinds, fuse wire, copper ingots, battery zincs, pig lead, spelter, etc. In addition, samples of their many brands of Babbitt were shown ,among which the Harris Heavy Pressure occupied a prominent place.

**The Dodge Manufacturing Co., Toronto,** occupied a large space with their well-known products for power transmission, including split wood pulleys, bearings, hangers, etc.

**The Garlock Packing Co., Hamilton,** had on hand a full line of their packings under charge of H. G. Fletcher, manager of their Toronto branch.

**The Chicago Pump Co., Chicago,** had on view their automatic electric condensation pumps for drawing condensation and air out of heating systems, and automatically returning the water to the boiler. The system is operated independently of the boiler pressure, no vacuum pump being used.

**The A. R. Williams Machinery Co., Ltd., Toronto,** had a good selection of machine tools including a flat turret lathe (Jones & Lamson type) by the Stevens Co., Galt; a Kearney & Trecker No. 1 Milwaukee miller; Schuchardt & Schutte No. 1 gear hobber; Gould & Eberhardt 14-inch shaper, etc., etc. They were also demonstrating the "Champion" tool holders made by the Western Tool & Mfg. Co., Springfield, Ohio.

**The Canadian Morehead Co., Woodstock, Ont.,** were represented by Mr. Geo. W. Cole, who was kept busy demonstrating and explaining the special features of Morehead non-return, return, vacuum and condenser steam traps.

**The Robt. Mitchell Co., Ltd., Montreal,** were demonstrating the Wood's Oiler, which has recently been put upon the market. This cylinder lubricator is suitable for steam engines, gas engines, air compressors, etc., and has many novel features. It is a force feed lubricator, yet there is no pressure in the sight glass or oil tank. Lubrication is effected by a pump which is positively operated by the steam pressure in the engine cylinder and which delivers the oil to the steam pipe in the usual way. The manner of accomplishing this is extremely interesting and well worthy of investigation.

**The Canadian Machinery Corporation, Ltd., Galt, Ont.,** had on view some of their leading lines of iron and woodworking machinery. The former included a 16-inch shaper, and an 18 in. by 8 ft. standard engine lathe, while the latter comprised a standard chain mortiser, 16-inch jointer with Falls automatic undercut attachment, mitre saw, and 8 ft. glue jointer.

**John Millen & Son, Montreal,** had a large show case display of Coventry noiseless chains for driving purposes. They also showed a novel application of these chains to automobile change speed boxes. Another prominent feature of their exhibit was a group of Cyclone high-speed chain blocks ranging in capacity from ½ to 40 tons.

**Wm. & J. G. Greey, Toronto,** had a large show of flour mill machinery, among which were an improved oat-flaking machine, a dough mixer and adjustable dough divider for cutting up dough into equal portions. The exhibit also included steel conveyor buckets, hand trucks and general mill furnishings.

**The Canadian H. W. Johns-Manville Co.** exhibited their asbestos products, roofing material, fibre conduits for underground wiring, J-M and Red Seal dry batteries, and high temperature cements for furnaces.

**Jones & Glassco, Montreal,** showed numerous examples of Renolds' Silent Chain for which they are sole Canadian Agents. This driving chain is well-known to all power users. Among their other exhibits were specimens of the Kenyon patent inter-stranded cotton driving rope, made by Wm. Kenyon & Sons, Ltd., Dukinfield, Manchester, Eng. They also showed Skefko Ball Bearings.

**D. K. McLaren** showed their well-known British oak-tanned leather belting, besides steel split pulleys and other mill supplies.

**The Borden-Canadian Co., Toronto.,** were kept busy demonstrating the Beaver die stocks for threading and cutting pipe. These die stocks have adjustable dies which do not require to be changed for the different sizes of pipe. Thus, the 6-inch die stock will cut all sizes of dies, and moreover, can be operated by one man.

**The Dominion Belting Co., Hamilton, Ont.,** showed driving and conveyor belts made from their "Maple Leaf" stitched cotton duck.

**The General Machinery Co., Traders Bank Bldg., Toronto,** showed Luitwieler Pumps in operation.

**The Chapman Double Ball Bearing Co., Toronto,** showed many examples of their well-known annular ball bearings and double ball thrust bearings. One large bearing in particular attracted much attention. This, a 6-inch double annular ball bearing, has recently been added to the company's regular line.

**The Carborundum Co., Niagara Falls, N.Y.,** showed numerous examples of their carborundum and Aloxite grinding wheels.

**The Elmira Machinery and Transmission Co., Ltd., Elmira, Ont.,** showed shafting hangers and bearings, split wood pulleys, etc.

**Cowan & Co., Ltd., Galt, Ont.,** had an extensive exhibit of their well-known lines of wood working machinery.

**The Lumen Bearing Co., Ltd., Toronto,** showed a great many samples of well-made die-castings on view.

**La Societe d'Air Liquide, Montreal** (formerly R. J. Levy), were doing oxy-acetylene welding and cutting in a tent outside the Machinery Hall. The company manufactures oxygen and liquid air and supplies complete oxy-acetylene equipments. They also do welding and cutting work by contract.

**The James Morrison Brass Mfg. Co., Toronto,** were located in the Process Building. Numerous and varied specimens of their well-known products were in views, such as steam and hydraulic pressure gauges, engine counters, injectors, stop valves, marine engine-room telegraphs, etc.

**The Linde Canadian Refrigeration Co., Montreal,** exhibited a belt-driven 20-ton ammonia compressor, operating in the Dairy Building. It was employed to care for the exhibits of the Farmers'

Dairy, the City Dairy, the Harris Abattoir, and others.

**The Cling-Surface Co., Buffalo,** were distributing literature and demonstrating the merits of their well-known belt-dressing.

**The Tallman Brass & Metal Co., Hamilton,** made a good display of their Arctic Babbitt Metal, as well as of brass rods and tubing, brass castings, brass signs, etc.

**The Consumers Gas Co., Toronto,** had a Crossley gas engine in operation, besides a number of gas accessories of various kinds. A furnace for hardening or annealing high-speed steel was shown, and also a gas fired rivet-heating furnace. This exhibit was in the Gas Building.

**The Positive Clutch & Pulley Works, Toronto,** exhibited a number of their wood-rimmed pulleys, with pressed steel spokes and malleable iron hubs. A features of these pulleys is their absence of windage. A combined jaw and friction clutch was also shown. In this friction, pieces made of fibre are employed to gradually pick up the speed of a shaft or pulley under load, after which the positive jaws are thrown into gear, the friction being disengaged at the same time. The whole operation is controlled by one lever.

**The Ontario Wind Engine & Pump Co., Toronto,** showed a large number of Strickney gasoline engines. One of 7 h.p. rested on two rollers of iron pipe without being bolted down. In addition, it had the covers removed from both journal bearings, and ran all day with very little vibration. The governor can be adjusted while the engine is running, and has a wide range.

**The Crescent Oil Co., Hamilton, Ont.,** showed lubricating oils, split wood pulleys, "Alligator" flexible steel belt lacing, etc., etc.

**Baines & Peckover, Toronto,** showed "Lincona" balata belts, tool steels by B. K. Morton & Co., Sheffield; and babbitts by the Atlas Metal & Alloys Co.

**S. F. Bowser & Co., Toronto,** were located in the Process Building, where they exhibited their well-known self-measuring pumps. These pumps are a great convenience in a large engine room, garage, railroad roundhouse, etc., where large quantities of oil are handled. An adjustable stop on the pump rod varies the travel of the plunger, and so controls the amount of oil delivered at each stroke.

**Chapman & Walker, Limited, Toronto,** had a large exhibit of motors and other electrical equipment.

**The Canadian Boving Co., Toronto,** showed a single cylinder Bolinder Semi-Diesel engine of 12 H.P. in operation A feature of this type of engine is its extreme simplicity, there being only three working parts exclusive of the fuel pump and governor.

**The Northern Electric Co., Montreal** had a very handsome booth in the Industrial Hall, where they exhibited their telephones, fire-alarm, apparatus, etc.

**The Dearborn Drug and Chemical Works, Chicago,** were explaining the merits of the Dearborn treatment of boiler feed waters.

**H. L. Peiler & Co., Montreal,** exhibited a full line of Bundy steam traps, Mason regulators. Their booth was shared by

**The Engineering Specialties Co., Toronto,** who had on hand an assortment of "Everlasting" blow-off valves, "Flexible" tube cleaners, etc.

## WORLD'S OUTPUT OF PIG-IRON.

MESSRS. James Watson & Co., Birmingham, England, have compiled their annual statistics of the world's production of pig-iron. They place the output for 1911 at 63,668,926 tons, a decline compared with the previous year of 1,938,867 tons, but 3,303,146 tons more than in 1909. In the United States there was a shrinkage of 3,649,201 tons in 1910, while in Great Britain there was a falling off of 498,107 tons. Germany on the other hand, makes rapid progress, an increase of 2,617,459 tons on 1910 being shown, and on 1909 of 741,787 tons.

The following table shows the output of the different countries for the past three years:—

| | 1909 Tons | 1910 Tons | 1911 Tons |
|---|---|---|---|
| United States | 25,795,471 | 27,298,545 | 23,649,344 |
| Germany .... | 12,917,653 | 14,793,325 | 15,535,112 |
| Great Britain | 9,664,287 | 10,216,745 | 9,718,635 |
| France .. .... | 3,544,638 | 4,032,459 | 4,408,025 |
| Russia ..... | 2,817,000 | 2,956,000 | 3,521,000 |
| Austria and Hungary .. | 1,947,300 | 1,990,684 | 2,089,867 |
| Belgium ..... | 1,632,350 | 1,803,500 | 2,072,847 |
| Sweden ..... | 443,000 | 604,300 | 633,800 |
| Spain .... .... | 420,000 | 425,000 | 435,000 |
| Canada .... .. | 677,000 | 740,210 | 824,345 |
| Italy .... .... | 147,000 | 343,600 | 253,322 |
| Japan .... .... | 161,020 | 162,000 | 162,000 |
| India .... .... | 39,350 | 35,933 | 49,205 |
| China .... .... | 74,000 | 120,000 | 110,000 |
| Mexico .... .. | 58,859 | 45,000 | 70,000 |
| New South Wales | 26,762 | 40,487 | 36,384 |
| Total ..... | 60,365,780 | 65,607,788 | 63,668,926 |

## GASOLINE MOTOR TRUCK MAINTENANCE COST.

A PAPER was recently presented by Mr. Louis Ruprecht, before the summer meeting of the Society of Automobile Engineers, at Detroit, on the "Cost of operating Gasoline Motor Trucks." Quoting a few of the figures given, the depreciation may be at from 10 to 15 per cent. per year, the tire value being deducted from the cost of the complete vehicle and the tires considered independently.

Driver's wages on a half-a-ton delivery wagon may be assumed to be about $2.75 per day, and on larger trucks from $3.00 to $4.00 per day.

Garage charges, including only the washing and storing of the vehicle, are on an average from $240 to $300 per year, according to the size.

Tire cost should be figured on the basis of a life of 8,000 running miles, as guaranteed by the makers.

Gasoline cost may be taken as about 11 cents per gallon, although at times it may be somewhat higher.

Oil may be assumed to be 30 cents per gallon, and one gallon of oil will be sufficient for 50 to 125 running miles according to the size of the vehicle.

Insurance will be from $100 to $250 per year, according to the size.

Repairs and replacements should be figured up to 3 cents per mile in the case of heavy trucks. This figure is based on extensive records.

### Compiled Data.

Based on these figures a table has been compiled which gives, in the first place, the fixed charges per day for different sizes of vehicles, and in the second the additional running cost per mile. For example, the cost of operating a six-ton truck, all charges included, 45 miles per day, will be $\$6+(0.1540\times45) = \$12.93$. The figures presented by the author also show conclusively that wherever a large tonnage is to be handled, it is of the highest importance to use a few large units instead of many small ones.

| Size of Vehicle | Fixed charges | Increment Per mile. |
|---|---|---|
| 1,000-pound | $5.07 | $0.0686 |
| 3-ton | 5.33 | 0.0860 |
| 5-ton | 5.60 | 0.1253 |
| 6-ton | 6.00 | 0.1540 |
| 7-ton | 6.15 | 0.1718 |
| 12½-ton train | 7.40 | 0.2070 |

## LABOR UNREST ON INCREASE.

INDUSTRIAL conditions were seriously disturbed by labor disputes during July, the number in existence in that month being considerably greater than the number existing during June. The number actually commencing however, during July compares favorably with that of the previous month. In all 46 disputes were reported to the Department of Labor, an increase of 9 as compared with June, and an increase of 28 as compared with July, 1911. About 17,000 employes were affected by these disputes, as compared with 15,000 during June, and 19,000 during July, 1911. A termination of the Garment Workers' strike in Montreal occurred during July, which caused a resumption of operations by more than 4,000 employes after nearly two months of idleness. Few of the disputes commencing during July were individually of serious consequence as factors in disturbing industrial conditions.

# Trade Journal Publicity--Its Meaning to Gas Engine Makers *

By E. R. Shaw **

*The place and power of the trade journal is here clearly demonstrated, and while the occasion on which the address was delivered particularized the field somewhat, it will be quite evident on reading over the paper that the contents are applicable to manufactures and industries generally.*

WHEN I was honored with a place on the programme of this Convention and assigned my subject, I was afraid that from such a long title you would suspect a long talk. I am not going to emulate a darky preacher who had the reputation of talking so long that nobody could keep awake, and who talked so loud that nobody could go to sleep.

### Potency of the Trade Paper.

The most potent factor in our industrial and commercial development during the past generation has been the Trade Paper. It has rapidly increased in importance in every field of endeavor. No other class of publications are read as thoroughly and earnestly as Trade Papers. We can all agree to the proposition that there is an inexorable principle in nature that is constantly seeking to establish an equilibrium, or in other words, to adjust things in such a way that friction will be reduced and waste effort abolished. The Trade Paper may be defined as a finely adjusted implement of twentieth century progress that automatically selects and attracts only the interested, and eliminates all others. Like other economic conveniences, specialized publications are unappreciated and discredited by some, but to the constituency which it seeks to aid, it goes modestly and noiselessly and greets its readers with a radiance of intelligence because it is one of the hand-maids of education. As a people we are looking for the best systems, for the most economical methods, and our progress as a nation is because of the fact that we have less conservatism, less routine in our way of doing things than have other nations.

In the material world there are no accidents recognized, and if we will but trace to their antecedent cause those things which we call results, we will find a well-defined reason for everything. Success is won by application of substantial reason—not chance. The Trade Paper is the embodiment of all that is substantial, the foundation of that which is safe and secure. Its pages reflect that which has been tried and found true. Its influence can not be overcome nor its power adequately estimated, for its force is always along the lines of least resistance.

### Trade Paper a Sale Producer.

There are about as many methods of developing sales as there are methods of developing power, and from the conditions it can be determined which method fulfills the requirements most accurately. The specialized Trade Journal is a thing of life and vitality which conforms to the economic laws of marketing in the special field it serves. It is an automatic selector of possible buyers and a developer of latent want into commercial demand. If rightly hitched to the load it is the modern engine for marketing those products whose customers can be segregated from the general public. The Trade Papers are the most effective and economical customer finders and sales makers in any field, because they are the publications which appeal to that field and to no other. Such publications, and only such, offer a practically wasteless way to place your product before those whose interest finds expression in orders.

### Trade Paper Advertising.

Of the millions of people in this country only a few thousand perhaps have any possible use for gas engines and their auxiliaries, and you can not afford to advertise through general mediums to the millions who have no interest in your product in order to reach the few thousands who are your possible customers. A salesman's time is too valuable to use for any of the work that can be done by advertising. So says a man who makes a business of training salesmen. The man who says "There is nothing like a good salesman to move your goods," thinks he has dealt advertising a body blow with that half-truth, but the man who has really thought about it and the man who has tried the combination says, "There is nothing like a good salesman and good advertising." That's the whole truth.

What may be called the machine work of selling, getting attention to the product, telling what it is and what it will do, and thus awaken interest and create desire—this is work for the printing press, because the printing press can do it in a wholesale or quantity way much cheaper than it can be done by salesmen. This work thoroughly done leaves the salesman only his proper function to perform, leaves to him the skilled hand and head work of showing the buyer just how the product fits his individual and perhaps unusual requirements, quoting prices, terms and closing the order.

### An Aid to Salesmanship.

How often have you invited a salesman in and given him a chance just because you had heard of his goods—had noticed, perhaps without consciously reading, the advertising of his house, and had been favorably impressed? Advertising does get attention and creates interest and desire now as never before, and the salesman who once regarded it with contempt or as a rival—as something that was after his job and would get it if he didn't watch out, now looks upon it as his most efficient assistant, as one of the tools of his business. He is the first to fight for it if it is in danger of being cut off or reduced. He even makes suggestions for its improvement, just through an enlightened self-interest, and the same motive moves him to see that advertising gets the credit for the work it has done in his territory—work which only he has had the opportunity to see.

### Suggested Line of Action.

Give your salesmen the help they are entitled to. Save their time, which is your money, by making your goods known—favorably known through advertising in the papers that are read by the people who use your goods. Use enough space to tell your story well and in an interesting way. Use enough space to impress the unknown prospect, who has no other way of judging you, that "here's something worth while; the man who makes it must believe in it, or he would not spend money advertising it."

Do that and you are well on your way toward the favorable acceptance of your product. How much is enough space? That depends on the product—how it is marketed, competition, distribution, a dozen things, perhaps, on which it is easy to get safe advice. If a full page is your size, a half-page might be extravagant. Maybe a quarter-page is enough, but decide to do it right, and do it right soon.

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*Read before the National Gas Engine Association, Milwaukee, Wis., June 20, 1912.

**President Federation of Trade Press Associations in the United States.

## EDUCATIONAL VALUE OF ENGINEERING MAGAZINES.*

By W. D. Robins.**

IN the engineering magazines, edited and published by present-day methods, there is a great deal of information which no ambitious man engaged in mechanical work can afford to overlook. A large and valuable part of this information is of such a character that it could not be obtained from any other source without a great deal of time and trouble. While familiarity with what is being done in the line of his profession is of undoubted value to the engineer who has attained a position involving important administrative or technical responsibilities, it is certainly of no less value to the draftsman or student whose experience is more limited.

### Intelligent Study Desirable.

Without intending to imply that there is any agency equal to actual experience for developing and forming the sound, level-headed judgment required in all branches of engineering work, it is the purpose of this paper to show that the knowledge of current practice, in a particular line of work, which can be obtained by intelligent reading of the engineering magazines, will be of great value in applying to actual cases the fundamental principles of design or operation. Though all engineering work is governed by mathematical laws, the application of these laws to actual work is by no means the exact science which their mathematical origin would seem to indicate. This is due partly to incomplete knowledge of the laws themselves and partly to the variable character of the materials used and conditions of operation.

### Editorial Features Current Practice.

Every student of machine design is familiar with the numerous formulas containing variable factors, such as factors of safety, safe stresses, empirical coefficients, etc., which represent the results of practical experience or scientific experiments. These factors, as given in the text books, often vary between wide limits; the proper value to be used for a given case being left largely to the judgment of the designer. By substituting in a formula the dimensions or quantities given in a magazine article describing a machine and then solving the formula for the variable quantity, an idea can be obtained of the value used in current practice for the class of work under consideration. The extent to which this practice may be carried out depends upon the opportunities of obtaining magazines and the time and mental energy remaining after the performance of the daily work. If it is not practicable to use the magazines in such a detailed manner as indicated above, it is still possible to use them to determine the application of principles in a more general manner.

Descriptive articles may show that for the same purpose, one power plant uses a direct-acting steam pump, another an engine-driven centrifugal pump and another an electrically-driven plunger pump. One bridge may be built of masonry, another of steel, and another of re-inforced concrete. Ship propelling machinery will be described in many combinations, from the torpedo-boat destroyer with oil-burning water-tube boilers and steam turbines, to the Western river steamer with flue boilers and simple engines exhausting to the atmosphere. By the habit of determining, as far as possible, from descriptive matter given, the reasons for the adoption, in any case, of the particular apparatus employed, a certain degree of familiarity with the subject is sure to be obtained. The practice of looking for the controlling factors of design is likely to develop the ability to determine what constitute these factors, and also what their relative importance is.

Engineers of high standing and varied experience have stated that the two most important branches of knowledge for a man engaged in engineering work are the principles of mechanics and the properties of the various materials used in the construction and operation of his work. Now, the principles of mechanics do not change; but materials do change, for the properties of materials continually vary with improved methods of manufacture, new materials and combinations of materials are being used, and familiar materials are being put to new uses. Much valuable information concerning materials and their uses can be found in the magazines long before it gets into text books.

### The Advertising Pages.

Again, the advertising matter in an engineering magazine contains a wealth of useful up-to-date and instructive information, because the modern methods of advertising depend more upon directing attention to the character and efficiency of the article itself than upon making vague and spectacular claims for it and enveloping it in an atmosphere of mystery, as was too often the practice in the past. When it is remembered that the use of unsuitable material for pipe-joint gaskets or valve-stem packings might seriously impair the commercial efficiency of a large power plant, it is apparent that any material or appliance used in engineering work, however trifling it may seem at first glance, needs careful study and inspection.

In conclusion, the writer wishes to emphasize the fact that nothing in this paper is intended to belittle the importance of actual experience. It is intended, rather, to suggest methods of finding information of real practical value in a lot of reading matter which is often put aside as containing nothing but dimensions and statistics.

*From a paper presented at the regular monthly meeting of the American Society of Engineer Draftsmen.

**Office of Inspector of Machinery, U.S. Navy, Philadelphia, Pa.

## COST OF OPERATING A 4-TON MOTOR TRUCK.

THE Howards Co., New Haven, Conn., has been operating a 4-ton motor truck, built by the Kissel Motor Car Co., Hartford, Wis., and the data compiled on this cost indicates that in 12 months the truck will effect a saving of $1,600, as compared with the cost of maintaining three two-horse teams, formerly required to do the company's hauling. This saving is effected after considering as depreciation the entire cost of the truck. A comparison of the cost of maintaining three double teams and operating the 4-ton truck is as follows:

**THREE DOUBLE TRUCKING TEAMS.**

| | |
|---|---|
| Cost of six horses at $300 | $1,800.00 |
| Cost of three wagons at $450 | 1,350.00 |
| Cost of six harnesses at $35 | 210.00 |
| Cost of keeping horses, $25 a month | 1,800.00 |
| Repairing harnesses, wagons, etc. | 100.00 |
| Interest on investment | 336.00 |
| Drivers' salaries, $12 a week | 1,872.00 |
| Total | $7,468.00 |

**"KISSEL-KAR" FOUR-TON TRUCK.**

| | |
|---|---|
| Cost of 4-ton truck | $3,800.00 |
| Gasoline, 2,400 gals. a year at 10c. | 240.00 |
| Oil, 156 gals. a year at 23c. | 35.88 |
| Drivers' salary at $18 a week | 936.00 |
| Amortization, 10 per cent. on $3,800 | 380.00 |
| Interest on investment | 380.00 |
| General overhaul, once a year | 150.00 |
| Total, truck | $5,921.88 |

This shows a balance in favor of the motor-driven vehicle of $1,546.12.

During the first few months of its operation the truck averaged 484 miles and the gasoline and oil consumption daily were 7.6 gallons and 2 quarts, respectively. It will be noted that in the figures covering the cost of operating the truck that in addition to charging the first cost of the truck, 10 per cent. is charged for depreciation. On this basis the economies effected by the use of the 4-ton truck are much greater than the figures indicate. These figures demonstrate that a truck can replace 8 to 10 horses and still effect an annual saving of approximately $2,000. If the truck owner had written off 20 per cent. for truck depreciation and estimated the truck's life at five years, a net saving of $3,000 per year would have been effected.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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Vol. VIII. SEPTEMBER, 1912 No. 9


## INDUSTRIAL UNREST.

THE growth of industrial unrest has proceeded at such a rapid rate and has assumed such formidable proportions as to constitute a menace so undesirable and fraught with truly unlimited destructive possibilities as to make both capital and labor pause in their imbecile efforts to paralyze one another.

The insistent tendency in the direction of combines, mergers and trusts, and the ultimate attempted concentration of power and administration in the persons of a few, is neither a sign of a country's prosperity nor a compliment to the morality, the intelligence and wisdom of the promoter autocrats who are personally involved. Again, while trades unionism is a necessary, yea, even a commendable institution, in the various spheres of industrial operation, it is common knowledge that, as in the trust sphere, autocracy and dictatorship of a select few have many times precipitated much unnecessary suffering and distress.

Stated briefly, capital and labor—the trusts and the trades unions, are warring for control of production, and where the latter is not directly involved, the trusts are seeking to acquire control of public utilities and services. It has been pointed out, that labor in seeking to regulate over production is unwittingly keeping up the selling price of commodities, and being, as all employes are, the principal and majority purchasers, they are demanding a set of conditions more or less inimical to their own best interests. The reasoning is sound philosophy, but human nature is fickle, having, as yet, little faith in, and being pretty well convinced that the odds are heavily against an increase in the spending power of the nimble dollar. Production will, of necessity, have to be controlled, and if trust control of public services and utilities is a criterion, which, unfortunately, we must make it, then no one can shut their eyes to the possibilities. Trades unions, on the other hand, have as little need to bolster up men within their ranks who are incapable exponents of a particular profession as they have those who will only use them as a lever to amass wealth.

In each sphere, there are undesirables; in the former, those who cannot work at a particular trade with sufficient aptness and intelligence to earn a living; and in the latter, those who will not, even if they could, work to attain the same end. It is perhaps one of the most distressing features of our 20th century civilization that most of us are in our wrong niche, and, therefore, incapable of furnishing our biggest quota of usefulness.

In a prominent marine engineering establishment, employing about 1,000 hands, 500 of whom probably were apprentices, much difficulty was experienced by a lad of eligible age in securing an opportunity to become one of the latter. The works rules stated very definitely that sons and daughters or other near blood-relatives of an employe would be admitted in preference to all others, and only in the event of the above supply source failing, was an outsider eligible. Needless to say, the supply did not fail, and as showing, in addition, how strong the desire for the perpetuation of the profession of marine engineering was implanted in the hearts of these parents, and how they compassed the certainty of their offspring being assured of an opening as apprentice, public opinion credited a child's name as having been entered on the company's apprenticeship list just as soon after birth as his Christian name had been determined. There is neither "trust" or "union" apparent in the foregoing relationship between employer and employe: as a consequence harmony prevailed.

The dictatorship of both Trust and Union almost regulates, to-day, who shall live, and a to-morrow may yet dawn in their regime when it will be determined who shall be born.

## THE FOUNDRYMEN'S CONVENTION AT BUFFALO.

FOUNDRYMEN throughout Canada and the United States are looking for the coming Annual Convention and Exhibition at Buffalo, in the latter part of the present month, to exert on their chosen calling a powerful and progressively forward impetus. Past experience has shown that widespread benefits have accrued to the trade through the medium of this combined function, and it is little wonder that the very liveliest interest among the members of the craft, operative and administrative, begins to make itself evident as the week for universal interchange of ideas and study of methods and apparatus developed in the elapsed interval, draws near.

The opportunity to visit the American Foundrymen's Annual Convention and Exhibition is one that every person connected with the trade directly and indirectly should grasp, and we are right in saying that those who have once availed themselves of the privilege are intensely desirous of being present again. The fact that Buffalo, N.Y., is the location of this year's Convention and Exhibition, makes possible for Canadian foundrymen a more or less extended visit, and from inquiries made, there is every prospect of a large and representative delegation being present. We will, as usual, have a booth in the main exhibition hall, at which Canadian visitors and others will be made especially welcome.

# MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

## EVERYDAY PROBLEMS OF THE MACHINE SHOP.

By J. H. R.

THE accompanying sketches are for illustrating the application of trigonometry to some of the everyday problems met with in the machine shop. While in many cases these questions would be dealt with in somewhat different fashion from that here shown—partly due to the mechanic not being conversant with the method of procedure, and largely to the practice of some tradesmen in resorting to trial means, the intention of the writer is to discuss the practical application of a few of these principles, and help to some extent those who are unfamiliar with this subject.

As the circumference of a circle bears a certain relation to its diameter, so also do the sides of triangles to their included angles. By the study and practice of the trigonometrical functions, we can determine the distance between any point on one side, to any point on the adjacent side of any particular angle, and vice versa.

### Problem 1.

The sketch, Fig. 1 illustrates a square, shaped or milled on the end of a shaft. This square is to fit a 2¼ inch spanner as shown, and there is required the diameter of blank necessary, before the squaring operation. Now, if we know the length of any two sides of a right-angled triangle, we can find the third by involution and evolution. The sum of the squares of the two shorter sides equals the square of the longest side, or hypotenuse. The required diameter in this case is the diagonal, a — d.

Referring to the figure, o — c = c — b = 1.125 inches. Squaring o — c = 1.125 × 1.125 = 1.2656. Adding o — c and c — b = 1.2656 + 1.2656 = 2.5312. Extracting the square root for length o — b = √ 2.5312 = 1.591 inches. Diagonal, a — d or diameter of blank = a — o + o — d or 1.591 × 2 = 3.182 inches or 3 3-16 inches nearly.

Again, o — b = the hypotenuse of the right-angled triangle ocb; then, by the formula pertaining to the trignometric functions. Hypotenuse =

$$\frac{\text{side adjacent}}{\text{cosine}} = \frac{\text{o—c}}{\text{cosine of ang. 45 deg.}}$$

$$= \frac{1.125}{.70711} = 1.591 \text{ inches.}$$

Then diameter of blank = 1.591 + 1.591 = 3.182 or 3 3-16 inches nearly.

### Problem II.

Fig. 2 shows another frequent visitor in the machine shop. The distance across the flats of the hexagon is to be 2¾ inches. It is required to find the diagonal measurement or diameter of blank from which the hexagon can be shaped or milled.

By the same process as that performed in the previous problem, we find the required size.

Half the distance across the flats or o — c = 1⅜ inches; then, by the formula,

$$\text{hypotenuse} = \frac{\text{side adjacent}}{\text{cosine}} \text{ or o —}$$

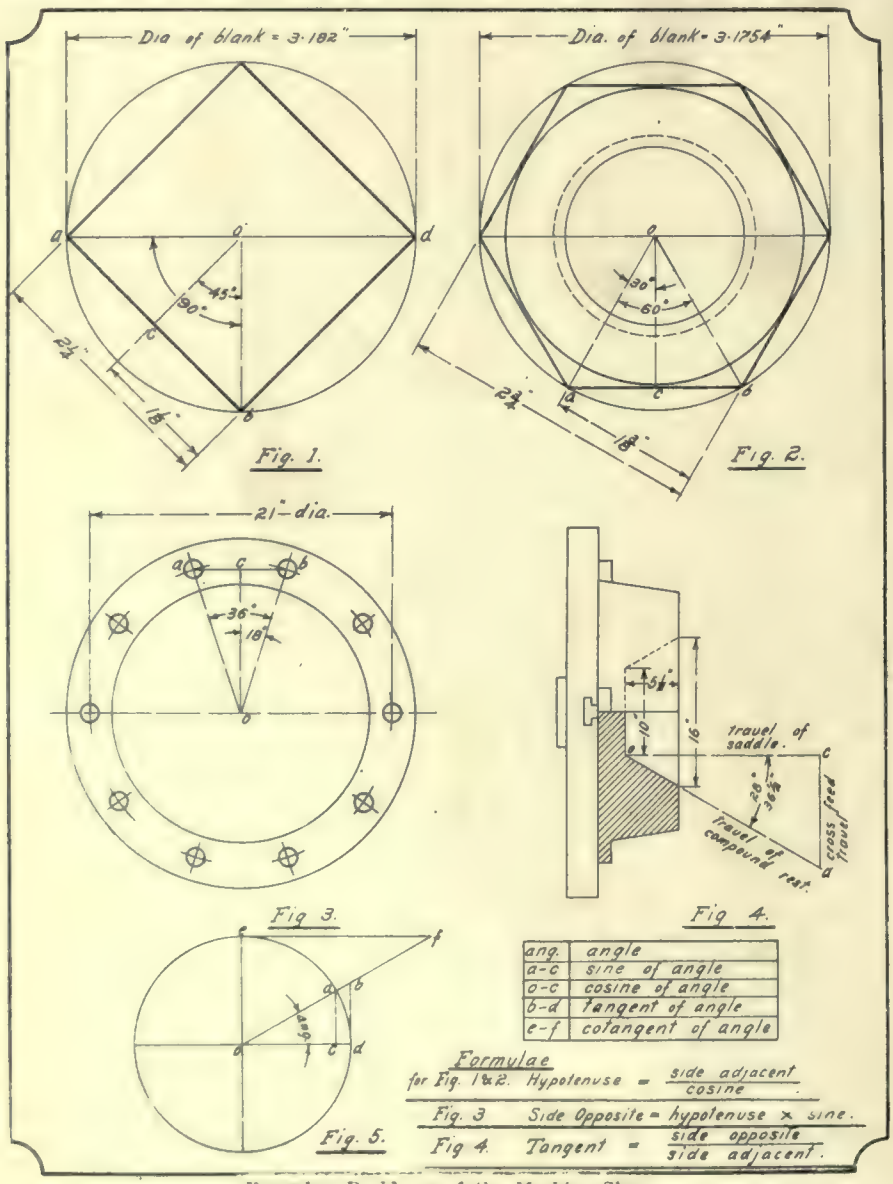
$$\text{a} = \frac{\text{o—c}}{\text{cosine of 30 degs.}} = \frac{1.375}{.86603} =$$

1.5877 inches for diagonal a — d. The diameter of necessary blank being 1.5877 × 2 = 3.1754 or 3 11-64 inches nearly.

### Problem III.

The spacing of holes around a circle is another problem often encountered in the everyday routine of the average mechanic. Fig. 3 shows a circular plate in which ten equidistant holes are to be drilled on a 21 inch circle.

The length of trammel required is the distance a — b. Bisecting the included angle of 36 degs., so as to form the right-angle triangle ocb, necessary for solution, we get the angle 18 degs., hypo-




Everyday Problems of the Machine Shop.

tenuse o — b, and the side opposite c — b.

Radius of the circle = 10.5 inches; then by the formula, side opposite = hypotenuse × sine, or o — b × sine of angle 18 degs. = 10.5 × .30902 = 3.2447 inches. The step of the trammel or distance a — b = 3.2447 × 2 = 6.489 or 6 31-64 inches nearly.

**Problem IV.**

Sometimes we will have a job for the lathe or boring mill which calls for a movement of the compound rest or swivel head. When definite sizes are given, it becomes necessary to use a little judgment or calculation to determine the right angle at which the cutting tool must travel in relation to the axis of the work. Fig. 4 shows a large casting on the face plate of a lathe. As is shown, three measurements are given—diameters of top and bottom and the depth.

In order to find the angle of the compound rest with the axis of the lathe spindle, the angle of operation is extended to illustrate more clearly the method of procedure, and the angle aoc is the required result.

Depth or side adjacent, o — c = 5½ inches.

Half the difference between the top and bottom diameters equals a — c or side opposite = 3 inches. Then, by the formula, tangent = side opposite / side adjacent or tangent of angle aoc = a—c / o—c = 3 / 5.5 = .54545. From a table of trigonometric functions, we find corresponding to .54545, the angle 28 degs. 36½ inches nearly.

The diagram Fig. 5 exemplifies the relative positions of a few of the trigonometric functions, with three of the formulae necessary for the solution of the above questions.

## SIMPLE DRILL FIXTURES.

By Donald A. Hampson.

AFTER a special wire forming machine had been put into service, it was found that two parts, the rod and the head shown in the drawing Fig. 1, needed rather frequent renewal. The head, as will be seen, was held by a pin which passed through one side of the rod, cutting out about 1-5 of its diameter . As the head and the rod did not wear out equally it was important to have some means of drilling both parts so they could be made up and used interchangeably. The writer was detailed to make up a dozen of each piece and as the easiest way of doing so, took the liberty of making a couple of simple jigs.

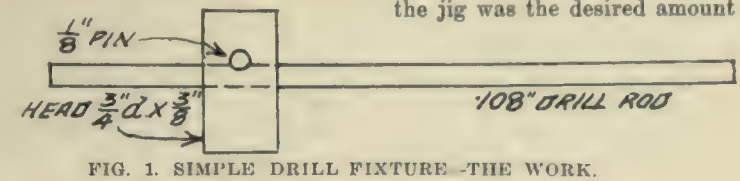



FIG. 1. SIMPLE DRILL FIXTURE -THE WORK.

Fig. 2 illustrates the jig made to drill the centre hole in the head. A piece of drawn steel was chucked and the hole for the head and the one for the

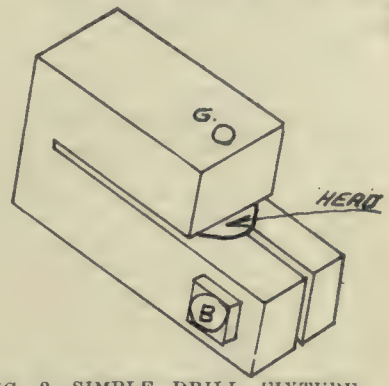



FIG. 2. SIMPLE DRILL FIXTURE. JIG TO DRILL CENTRE HOLE IN HEADS.

guiding of the drill (G) made concentric with each other. Two saw slots were cut, a binder screw (B) put in, and the piece case-hardened. For drilling the pin hole, two pieces of flat stock were selected. The lower piece was drilled and slotted for the head and the guide hole (G) put in; see Fig. 3. The upper piece was drilled and slotted for the drill rod and was carefully located over the lower member and screwed fast. Both pieces were provided with binder screws (B) and the outfit hardened. In service, the head was inserted and clamped; then the rod was slipped through the centre hole of the head and pushed up until its projection beyond the jig was the desired amount as measured with a scale. When clamped, the jig was turned over on its side and the pin hole drilled.

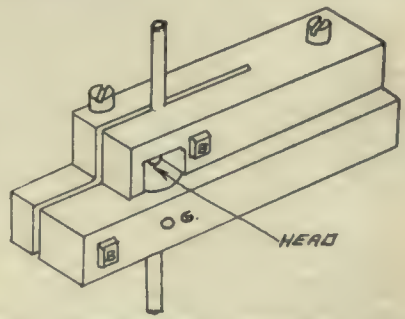
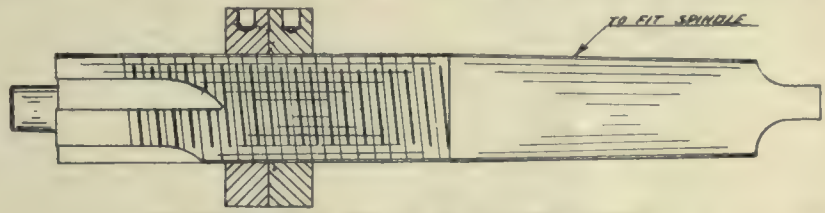



FIG. 3. SIMPLE DRILL FIXTURE. JIG TO DRILL PIN HOLE.

The work turned out by these tools was highly satisfactory and the manufacturer owning the machine gladly paid for the jigs when their utility was explained to him. Having a post drill of his own he could then duplicate the parts himself as desired and at very little expense. That they would be accepted was in mind when the tools were made, otherwise, that for drilling the centre hole in the head would not have been constructed, for this hole could easily have been produced in the lathe When making-up only one part at a time, a dummy drilling piece of the other part was used in the jig, Fig. 3, to offset the "running" of the drill when striking the unsupported portion.

This case is a good example of the value of plain jigs for a few parts. Had no jigs been made, it would have taken at least half as long to make up the original dozen sets, using ordinary shop appliances as it did to make the tools and do the job with them. Again there was future need which the jigs would care for most economically.




COUNTERBORING HOLE S TO GAUGED DEPTH.

## COUNTERBORING HOLES TO A GAUGED DEPTH.

By E. W. Tate.

ILLUSTRATED herewith is a counterbore which has been successfully used in the shop where the writer is employed. It is made practically the same as the common counterbore except for a left hand thread, check and adjusting nut. It is obvious with the left hand thread, that should the nuts become loosened, the hole would be finshed to a lesser depth rather than a greater, thus preventing spoiling the piece of work.

## AUTO-TRUCK OPERATION.

TO ascertain the exact cost of the operation of its motor truck, the Erie Malleable Iron Co., Erie, Pa., has devised a daily report sheet, which is filled out by the driver and covers practically every item of interest pertaining to the operation of the truck. Columns are provided for entering the time when the truck leaves the foundry and returns, and an accurate record is maintained of the weight of the material carried on each trip. Columns also are provided for the mileage covered, gasoline consumed, cost of repairs and other expenditures.

This daily report blank has enabled the company to compile interesting statistics covering the cost of operating its 1½-ton truck and the following data covers one year's operation:

Total mileage, 7,219½.
Average length of haul, 1.58 miles.
Total cost of gasoline used, $98.30.
Total cost of oil used, $55.83.
Total cost of tires, tubes, etc., $331.32.
Treads, $142.78.
Garage supplies, $25.25.
Repairs and overhauling, $28.36.
Wages, $780.
Insurance, including liability, collision and fire, $178.
Depreciation, $500.
Total cost of operation, one year, $2,114.7
Tire expense, per truck, per mile, $0.0656.
Total weight hauled, 2,449 tons.
Total cost of operation per ton mile, $0.0576.
Total cost of operation per mile, $0.2928.

## PAINTING PATTERNS.

AT a joint meeting of the Steel Founders' Society and the American Society for Testing Materials, the subject of coloring patterns for steel castings was discussed and a uniform system was adopted. The finished surface is to be painted red, the rough surface yellow, and all core prints are to be painted black. The Treadwell Engineering Co., Easton, Pa., is sending to the trade a card containing a pattern in colors which clearly shows the scheme adopted by these two organizations.

## A DOWNWARD MOVEMENT.

AFTER an almost continuous advance for the past twelve months, the Department of Labor's index number dropped two points in July, standing at 134.8 as compared with 136.9 in June and 126.9 in July, 1911. The chief decreases during July were in fruits and vegetables, grains and fodders, fish, animals and meats; increases being recorded in hides, leathers, boots and shoes, metals, fuel, lumber and furniture. Some 250 articles, selected to represent Canadian production and consumption, are included in the calculation by which a comparison is made of wholesale prices at the present time with the average price prevailing during the decade 1890-99.

## MOTOR TRUCKS REPLACE HORSES.

WHAT seems to be the proper breadth of view regarding the superiority of motor delivery over horses is taken by A. E. Holmes, of Chicago, superintendent of a large retail furniture house. Mr. Holmes' concern replaced fifty horses with five Kissel Kar three-ton trucks, which have rendered a much cheaper as well as better service. Mr. Holmes thus expresses himself. "In our business we must be up-to-date. Our customers demand the best we can give them in service as well as in goods. Even if motor trucks were more expensive—which they are not—we would never go back to horses."

## WHY MANGANESE-BRONZE CASTINGS LEAK UNDER PRESSURE.

THE extensive use of manganese bronze at the present time, and the fact that it is a strong metal, has been responsible for trouble when used for hydraulic work, high air pressure, or similar goods.

The reason that manganese bronze castings leak in this manner is because of the aluminium in them. They cannot be made, however, without the aluminium.

Aluminium, as is now well known, oxidizes when melted and wherever exposed to the air. There is always a film of oxide on the metal when it is poured, and this film becomes intermingled with the molten stream and enters the casting. So far there has been no known method of keeping it out. The result is that the casting is filled with particles of oxide of aluminium. When pressure is applied in testing the casting, these particles (they are frequently flakes, as the microscope will show) form channels, on account of not uniting with the metal, through which water, air, or other liquids or gases may pass. Hence the leakage. The remedy is to make castings to stand pressure of a good copper and tin mixture that will cast without a film of oxide and give a clean metal. This has been the universal verdict so far.—Brass World.

**Boiler Tubes.**—Increased efficiency and lengthened life of boiler tubes are claimed by the Topeka Edison Co., as the result of firing its boilers with fuel oil introduced from the rear of the combustion chambers. According to the Vulcan, the Topeka generating station contains four 260 horsepower, four 300 horse-power, and two 508 horsepower boilers, all equipped with rear-fired burners. A 2½-in. false floor, consisting of a single layer of firebrick, separates the combustion chamber from the air inlet ducts, each of which contains an oil burner. The heat from this partition floor helps to warm the air before it reaches the rear, and enters the furnace at the burner. Each of the smaller boilers is equipped with two air ducts and burners, and each of the 500 horsepower units with three. Oil is delivered to the fuel valves at 30 lb. per square inch pressure, while steam is taken directly from the boilers through throttling valves, reducing it to 75 lb. pressure. Each burner is made up of duplicate 10ft. lengths of ⅜-in. oil pipe and ¼-in. steam pipe, which connect the valves at the front of the boiler with the burner at the rear. Besides the steam and oil supply valves, there is a third or blow-out valve, by means of which steam can be turned in to blow all oil out of the fuel pipe when shutting down the burner.

**Furnaces.**—Considerable attention has been devoted on the Continent of Europe, lately, to various kinds of furnaces and appliances for burning coal-tar oil, naphthalin, etc. The production of coal-tar oil in Germany during the last five years has risen from 150,000 tons to 400,000 tons, and new uses have had to be found for it. Its application is now wide in puddling furnaces and open-hearth furnaces, and in enriching blast furnace gases where they are used for power production. It is also used in the Diesel motor. There is much to be said, however, against the use of raw coal-tar as fuel, because it contains up to 10 per cent. water, which has to be paid for, carried, and freighted as tar, and which is useless, or even harmful, in combustion. It is, further, only a raw material, and contains valuable elements which may be extracted as by-products, but which are lost when the tar is consumed as fuel. Coal-tar is not well adapted to be used as a fuel, at least in present furnaces, because it is viscous, and apt to clog the nozzles; also, notwithstanding many experiments in this direction, it cannot be used in a Diesel engine with any reliability of operation.

**Brandon, Man.**—Tenders addressed to Mr. Harry Brown, City Clerk, City Hall, Brandon, will be received until noon of September 27, 1912, for the delivery of two return tubular boilers and stokers. Specifications, etc., may be obtained from A. W. Shaw, engineer, Brandon.

**Mr. H. E. M. Kensit,** who during the past four years has been occupied in investigating and reporting on various undertakings and projects in Canada and the United States for Messrs. Smith, Kerry and Chace, of Toronto, has received an appointment with the water power branch of the Department of the Interior, Ottawa.

# The Development, Use and Treatment of Alloy Tool Steel

By Frank Walker

*Readers of Canadian Machinery are already familiar with the writer of this article, as a result of previously published data concerning other phases of this important requirement of our machine shops, etc. Much complimentary correspondence was received by us on former occasions, and we believe that a careful perusal of what follows will again lead to widespread satisfaction.*

METALLURGICAL research of recent years has proved beyond question that the addition of small quantities of certain of the rarer metals to that combination of iron and carbon which is popularly known as "steel," imparts properties to it which increase its efficiency in the many and various uses to which it has been adoped. Steel made in this manner is known as "alloy-steel," to distinguish it from the older "carbon-steel," in which any metals or elements other than iron and carbon are present only as unavoidable impurities.

**Manufacture of Alloy-Steels.**

In the manufacture of alloy-steels, various metals are used, each one giving a characteristi and distinctive property to the mixture, but in all the combinations, the object aimed at is to increase the hardness and toughness of the resulting steel. The metals most generally used, and whose properties are most generally understood, are manganese nickel, chromium, tungsten, molybdenum, vanadium, and titanium. It must however, be remembered that the use of each or any of these metals does not eliminate the element of carbon, but that carbon must be present in any alloy-steel to some extent; in other words, alloy-steel is carbon-steel with a certain amount of some of the above metals added. At the same time, careful experiments and observations determine, that in order to obtain the best results, an increase in the amount of the added metals must be accompanied by a corresponding decrease,—within certain limits, in the carbon content.

**The Scope of Alloy-Steel.**

One of the oldest and most generally accepted uses of steel is in the manufacture of cutting tools and instruments, and in this paper, the writer proposes to deal with the use of alloy-steel as a substitute for carbon-steel in the cutting tools employed in the various processes of engineering construction, giving the approximate proportions of an alloy or mixture which will give good general service under ordinary conditions, without being too expensive, and also to endeavor to state clearly the treatments to which such an alloy must be subjected in order to obtain from it the best actual working results. It should be borne in mind that this class of steel may be obtained in short bars suitable for use in patent tool-holders; these short pieces being made in requisite sections and lengths, and fully treated, so that no other process than that of grinding is necessary to prepare them for service. This method of employing alloy-steel is much to be commended for small establishments.

**Evolution of Alloy-Steel.**

The evolution of a reliable alloy-steel suitable for cutting tools has entailed a large amount of chemical research and actual experiment, but the results have more than justified the labor and expense for the many advantages gained by the use of tools of this kind are now fully acknowledged by the commercial world. The principal of these advantages is their increased cutting efficiency; speeds, feeds and depths of cutting being attainable when otherwise impossible with ordinary carbon-steel tools. This characteristic has led to alloy-steel being usually described as "high-speed" steel.

Another great advantage gained by the use of high-speed tools is, that at the fast cutting speeds it is possible to adopt, a given weight of metal requires less power for its removal. In some simpler operations, this gain amounts to as much as 25 per cent. This characteristic property of alloy tool steel as compared with hardened tool steel lies in the capability to maintain hardness, notwithstanding the high temperature developed at its cutting edge by the friction of cutting. An ordinary tool steel with a carbon content of, say, from 1.0 to 1.20 per cent., however carefully it may be hardened and tempered, will commence to soften, and return to an annealed condition, if its temperature be raised above 400 deg. Fah., and the lower the temperature of a tool is maintained the longer will be the life of its cutting edge. This necessarily limits the speed at which cutting can be accomplished, but with high-speed steel a temperature of 1,000 deg. Fah., or even higher, may be produced by friction at the cutting edge without seriously affecting its hardness. It has been determined by careful experiment, that to do effective cutting, the tool should be at least three times as hard as the work, so it stands to reason that the best steel for the purpose is one that will maintain this proportion, under the conditions imposed upon it for the greatest length of time.

**Constituents of Alloy Tool Steel.**

The metals most generally used in making alloy tool steel are tungsten, chromium and molybdenum, and the best high-speed steels in ordinary use at the present time are combinations of iron and carbon with, (1)—tungsten and chromium: (2) — tungsten, chromium and molybdenum; (3)—chromium and molybdenum. Of these three metals, tungsten is by far the most important and is contained in almost all the principal high-speed steels; the percentage of its content having been defined by careful experiment at from 9.0 to 16.0. The chromium content has been determined in the same manner at from 2.0 to 4.0 per cent., while the advantages of molybdenum are open to question. It has been found that the addition of from 1.0 to 3.0 per cent. of molybdenum to a tungsten-chrome-steel increased its cutting efficiency, but not by such an amount as justified the cost of the added molybdenum, while, at the same time, it complicated the heat-treatment of the tool, as molybdenum alloy-steels cannot be heated above 1,800 deg. Fah., without seriously impairing their efficiency.

**Reliable High-Speed Steel.**

The approximate analysis of a thoroughly reliable high-speed steel is:—carbon, from .50 to .60 per cent.; tungsten .13 to .14 per cent.; chromium 3.25 to 3.75 per cent. This combination, with the presence of a slight percentage of silicon, represents, in the writer's opinion, the best alloy for cutting tools, —turning, planing, etc., used in the all round work of a general engineer's shop. With tools made from an alloy of this class, nickel-steel shafts having a carbon content of .30 have been turned at a speed of 162 feet per minute, with a cut ½ inch deep and 1-16 inch feed; the tools cutting for over six hours with one grinding, although the frictional temperature developed at the cutting-edge rose to over 1,100 deg. Fah.

**Heat Treatment.**

The heat-treatments of high-speed steel with the exception of that of annealing, are much more simple than those required for carbon-steel, inasmuch as accurate limitations of temperature are not so necessary, and the delicate operation of tempering is not required. If careful attention is paid to the following points,

no difficulty need be experienced in its use.

With regard to the annealing process, this entails extremely refined thermal treatment, and requires special appliances, so that it is much better that it be performed at the factory before the steel is put on the market. Buyers of this steel in the bar should insist, therefore, upon obtaining a guarantee that this process has been effected before they accept delivery. The necessity for accurately annealing this class of steel arises from the conditions under which it is made. In the process of manufacturing, the steel is cast into ingots which are drawn down under high-speed power hammers into bars of the required size and shape, this process is called "tilting," and gives rise to serious internal strains in the structure of the bar. To remove these and bring the steel to a state of molecular uniformity, and at the same time render it sufficiently soft to be machined if desired, thorough annealing is necessary.

The process is as follows:—The bars of steel are taken from the tilt to a special muffle furnace designed for heating by radiation only. In this furnace they are charged in such a manner that heat can circulate as freely as possible around each bar; care being taken that during charging, the heat of the muffle is maintained at the same temperature as that of the bars when received from the tilt. When charged, the muffle is closed and its temperature raised slowly to 1,400 deg. Fah. This temperature is most accurately maintained for from 12 to 24 hours, according to the section of the bars being treated. The fires are then allowed to die out and the muffle and its contents are allowed to gradually cool down to atmospheric temperature, the bars being afterwards withdrawn and straightened ready for service.

### Heat Treatment by Toolmaker.

The heat treatments to which the steel is subjected at the hands of the toolsmith are, as remarked above, extremely simple, the main point to be observed being to break every rule usually applied to carbon-steel. This sounds paradoxical, but it is nevertheless true. The actual forging should be carried out at a bright yellow "greasy" heat—about 1900 degrees Fah., and before the piece is withdrawn from the fire it should be well "soaked" at this temperature, to insure its extending through to the core or heart of the piece. The forging should be done quickly, and if not completed before the heat falls to a bright red,—about 1500 deg. Fah., it must be returned to the fire and heated up again. The best fire to use when working high-speed steel is one made from clean gas coke.

The peculiar methods necessary with steel of this description have frequently been the cause of failure on the part of blacksmiths of the older school to give satisfaction in working it, but it must be clearly understood that an alloy-steel, with an analysis approximately as given above, cannot be spoiled by overheating short of actual fusion. A point that must be borne in mind, is, that on no account should a bar of high-speed steel be broken cold for use. If the breaking of a bar is unavoidable at any time, the broken ends should be heated and cut off some ½ inch from the fracture. The breaking of the bar cold almost always causes fine end cracks which will develop in forging and cause considerable trouble.

### Hardening High-Speed Steel.

The hardening of high-speed steel is also very simple. To obtain the best results, it is only necessary to observe the following rule. This steel exhibits, as does carbon steel, that peculiar phenomenon in heating known as "the period of decalescence," and experiment has proved that the higher its temperature is raised above this critical point when reheating it for hardening, the higher will be the frictional temperature that the tool can withstand without sensibly losing its hardness. When hardening, therefore, care should be taken to raise the steel to a bright white heat,—about 2200 deg. Fah., just short of melting; in fact, no harm will be done if the extreme point of the tool be slightly fused. It should then be allowed to cool down in a brisk current of air. It is not advisable to allow the hardening heat to extend far up the tool, but it should be confined as far as possible to the cutting edges.

### Grinding.

A very important operation in preparing the tool for use is that of grinding. It must be borne in mind that the largest makers of high-speed steels are also their largest and most exacting users, and their experience goes to show that no better method of grinding this class of tool can be adopted than that of the old wet grindstone, using hand pressure only. Rough grinding on dry emery-wheels before hardening has been resorted to in some cases, but the results have not proved as satisfactory as when the tool has been forged to shape on the anvil, hardened and then accurately ground on a wet sandstone by hand.

In the splendidly equipped machine shops of the Armstrong-Whitworth Co., The Cammell-Laird Co., or other large firms who combine the business of battleship building with that of steel manufacturing, one is struck by the number of wet grindstones conveniently located at different points, at each of which a skilled tool grinder is stationed to attend to the wants of the machinists. This system is also more conducive to an increased output than that of allowing the machinists, etc., to grind their own tools.—Relays of the various tools in use are kept at each grindstone, and a machinist has only to send or take his dull tools to the nearest stone, and receive from the grinder in return an equal number of similar tools sharpened ready for use.

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## Trade Gossip

**Maisonneuve, P.Q.** — A report states that the Federal Government will spend about $200,000 on the erection of a post-office in this municipality. The Minister of Public Works, Ottawa, will call tenders for the construction work.

**Winnipeg, Man.**—Materials for the extension of the fire service waterworks have been awarded as follows:— High pressure water pipe and specials, Canada Iron Corporation, Montreal, $64,-211.71; valves, Rensselaer Valve Co., Troy, N.Y., $3,537.50; hydrants, Florence Iron Works, Philadelphia, Pa., $11,484.

**Welland, Ont.** — The pumps at the new pumping station of Welland, Ont., have recently been put into service. The pumps were constructed by Messrs. Frank Pearn & Co., Ltd., Manchester, Eng., and supplied by the Canadian Boving Co., Bay street, Toronto. The water wheel is designed for the following:—Net head, 7 feet; normal output, 200 brake horse-power; maximum output, 250 brake horse-power; normal speed, 58 revolutions per minute.

**The J. N. Lapointe Co., Marlboro, Mass.**, makers of broaching machinery, recommend the use of the following compounds when broaching steel: 2½ pounds of soda-ash; 3 gallons of mineral lard oil; and 50 gallons of water. Mix the soda-ash and the lard oil with 10 gallons of water, and add the other 40 gallons afterward.

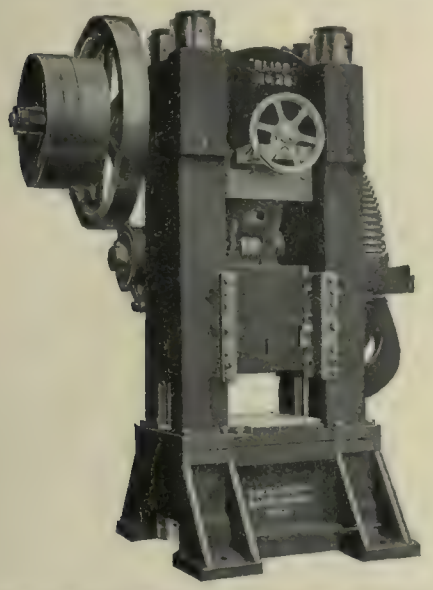
**The Smart-Turner Machine Co., Ltd., of Hamilton,** have recently secured the following orders:—American Radiator Co., Brantford, Ont., single acting triplex power pump; Welland House, St. Catharines, duplex pump; St. Lawrence paper mills, Mille Roches, Ont., centrifugal pump; the Nova Scotia Steel & Coal Co., Ltd., New Glasgow, N.S., one pair of rotary pumps; the Steel Castings Syndicate, Hamilton, triplex power pump; Mr. John Ritchie, Woodbridge, Ont., centrifugal pump; Berlin Brick Co., Berlin, Ont., duplex pump; the Hamilton Brewing Association, duplex pump; Dryden Timber & Power Co., Dryden, Ont., automatic feed pump and receiver.

# DEVELOPMENTS IN MACHINERY

**A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.**

## LARGE KNUCKLE JOINT PRESS.

DURING the last few years, there has been a continually increasing movement towards the building of presses of large proportions and great capacities as well as presses of new design.



Bliss No. 26 Knuckle Joint Embossing which exerts 800 tons pressure.

Every day it is demonstrated in manufacturing establishments that by means of power presses many articles can be made more economically and more uniformly than with the older methods employed. One of the new lines of knuckle joint presses recently brought out by the E. W. Bliss Co., of Brooklyn, New York, is shown in the accompanying illustration. These are designed for heavy stamping and embossing operations on steel, brass, copper, silver, britannia, etc., being particularly adapted for embossing operations in the manufacture of metals, coins, regalia, jewelry, watches, etc.

The knuckle joint principle gives with the minimum amount of friction and power a most powerful movement to the slide at the end of the stroke when the work is being done. In addition, it provides a slow movement at this point; so desirable when necessary to have the metal flow while under pressure, as in embossing. The machine is capable of exerting a pressure of 800 tons. As will be seen, the bed is stationary, and the toggle links are placed above the slide in the same position as pitmans in an ordinary crank press, being operated by a crank shaft in the rear. This construction not only allows of a longer stroke to the slide, but also permits of the use of positive knockout attachments in the bed and cross-bar knockouts in the slide, a feature appreciated by practical press men. The powerful jaw clutch with which this machine is operated, has three engaging points and is operated by a foot treadle at the right of the machine. The necessary adjustment for dies and pressure is obtained by a taper wedge adjustment. The position of this wedge is determined by means of a screw, which is operated by means of the hand wheel shown.

The machine is of tie-rod construction; the bed and crown piece each being separate castings. The side housings, which take the side strain and provide bearing surfaces for the slide and crank shaft, are also separate and of box section. Through them pass the four large vertical tie-rods which bind the machine together and take the entire strain when the press is doing its work. This method of construction not only acts as a guarantee against breaking the frame, as would be possible with a solid frame, but also provides a means of releasing the press should it become stalled on its center, as the tie-rods may be heated and expanded through suitable openings provided.

Some of the dimensions of the press shown that may be of interest, are:

Distance between uprights,28 inches.

Stroke of slide. 2 inches.

Area of slide flange, F.B. by R.L., 16 x 22 inches.

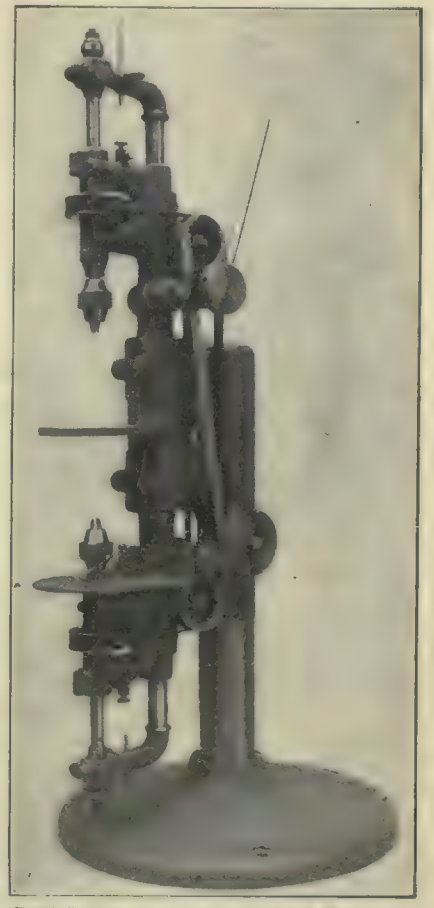
Area of top of bed, F.B. by R.L., 27 x 34 inches.

Total weight of machine, 45,000 pounds.

## BEAD DRILLING OR COUNTERBORING MACHINE.

THE machine shown was designed by Langelier Mfg. Co., Providence, R. I., U.S.A., especially for counterboring the string holes in both sides of necklace and other beads. It consists essentially of a rigid column set into a wide base for attaching to the bench, supporting two sensitive drill frames so disposed that the drilling spindles work towards each other when manually operated by the lever shown, or by a foot feed passing through the bench and operated by treadle. The main driving pulleys are on opposite sides of the machine. The driving shaft extends through the column and drives both drilling spindles by means of an endless belt.

The work is mounted on a low, flat fixture, set on the top of the fixed table shown midway between the drill chucks. The top of this table is exactly central between the drill points. The table may be swung to one side if desired. The two spindles are actuated through pinions, and mesh into a connecting rack. By this means, the countersinking of both sides of the bead is kept uniform. ½ inch vertical adjustment has been provided to each spindle to obtain the proper cutting position to the trills on beads of different sizes. The accuracy can be further controlled by means of the vertical depth gauges shown passing through the frames of the machine. These gauges may be set to any required

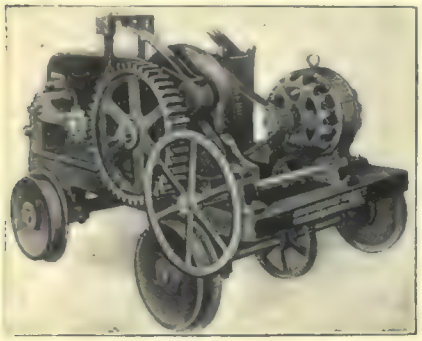


Bead Drilling or Counter Boring Machine.

distance and closely regulated by means of a knurled adjusting screw or anvil on which the tips of the gauges strike. The bench space occupied is 15 by 17 inches, and the machine weight is 114 pounds.

## MOTOR OPERATED PORTABLE SHEAR.

A NOVEL motor application is shown in the accompanying illustration of a John Evans & Sons, shear mounted with its driving motor on a small flat car. The places where this machine may find a use are limited, but it is a very valuable adjunct to wholesale hardware houses, factory storehouses, railroad shops, or other places where metal bar or strap is handled. The car designed for standard gauge track and propelled by the hand wheel, is run along in front of the bins containing the material, to



Motor Operated Portable Shear.

point where the latter are cut to desired length. The shear motor is of Westinghouse make, 7½ horsepower, operating on three-phase alternating current. The current is conveyed to the motor by means of a long flexible cable, or, when used over a track of any length, a number of junction boxes for making connections to the motor is more satisfactory.

## HORIZONTAL CHORD BORING MACHINE.

DESIGNED especially for use in the fabrication of the new Quebec Bridge, being built by the St. Lawrence Bridge Co., Montreal, our illustration shows a horizontal chord boring machine which is one of a number of units mounted on a long base, there installed. As a matter of convenience and economy, the long sub-base is in some instances constructed with I beams in place of the castnor base shown. The immense size of this new Quebec bridge, with its chords, pins, I bars, etc., is now so well known as to convey without special mention, the powerfulness and rigidity of equipment necessary for machining operations.

The chords, upon which the machine will operate, range up to 7 ft. 10 in. in section, and from 75 to 100 tons each. When dealing with such work, the chords are placed on parallels supported by the long sub-base, and the machine is adjusted on the base by power until the spindle is properly aligned for boring. It is then securely clamped and the table elevated against the chord to insure rigidity. On the heavy chords, the boring is accomplished by traveling head boring bars attached to the spindle sleeves by means of large diameter flanges. Feed is obtained by a pendulum arrangement, and as the webs of the chords are equidistant, about 14 or 16 inches, reversing fast power traverse to the heads is obtained in a simple and inexpensive manner, by the use of a square chuck mounted in an air drill. When boring smaller parts, the work is bolted to the elevating knee and the machine spindle feeds utilized.

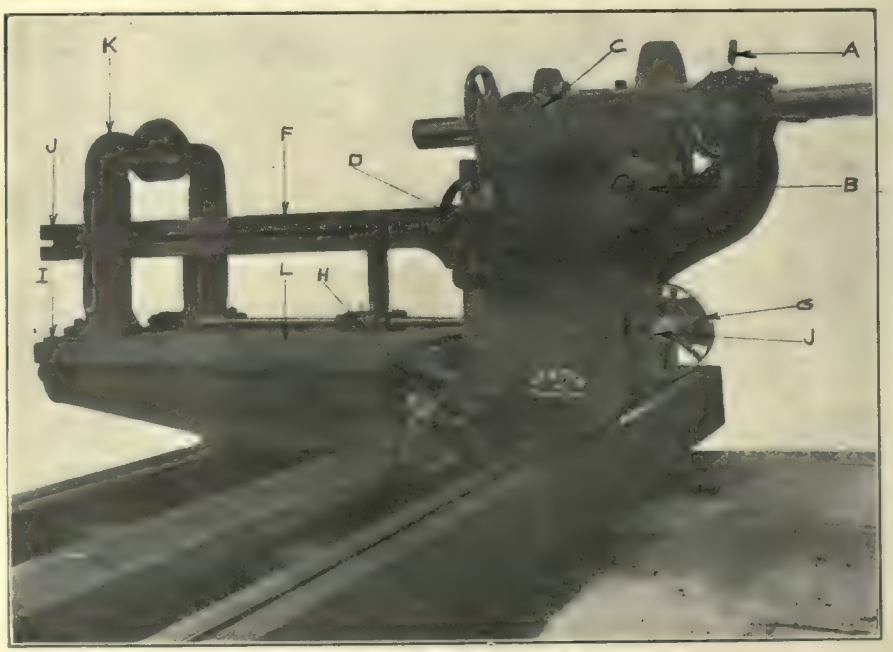
The spindle, 6 in. diameter, has 30 in. of feed with eight changes and hand control, and is fitted with a No. 7 Morse taper, with drift and retaining key slots. It is of alloy steel and fitted to the driving sleeve worm wheel by double key splines. Feed to the spindle is obtained by a steel rack fitted to the sleeve, and cuts may be started by hand by means of gear reductions, or fast traverse by hand is provided for at (A).

### The Drive.

The drive is by worm and worm wheel; the worm wheel having a bronze ring with teeth of steep lead. The worm is of hardened steel and is fitted with roller thrust bearings. Both are supported in a common bearing to eliminate chatter; the horn taking the feed thrust is also cast solid. Motion for the drive is taken from a General Electric Co. motor attached to the rear of the head, either direct or through back gears to the worm shaft, on the end of which the reversible feed cone (B) is located, which in turn is belted to cone (C). Motion for rapid traverse is taken from the motor pinion to the shaft (D), which carries two loose pulleys connected by a clutch. The inner face has friction engagement for elevating the knee (F) through belt connection to pulley (G), and the outer face has a tooth clutch. The outer pulley connects by belt to pulley (H), for fast traverse of the entire unit on the sub-base.

The base of each unit is of heavy type construction and is planned on the end for attachment of extension if desired. Each base, entirely surrounded by an oil pan, is 20 inches deep and the working surface is 7 ft. 1 in. long and 48 in. wide. The knee has a finished top surface 28½ in. wide, 7 ft. 10 in. long, and has longitudinal grooves milled-in for the reception of parallels to preserve the finished surface. In addition to the power movement, the knee can be elevated by hand at positions (J) from 8½ to 28 in. from spindle centre to top table. The distance from centre of spindle to base work surface is 38½ inches.

The alignment of the elevating knee is controlled by a vertical bearing on the head and by the yoke (K). When the nature of the work demands, the knee and elevating screws can be readily removed, leaving a clear working surface on the base (L). The maximum distance from end of spindle to yoke is 74 inches, and the yoke may be adjusted to any position within this length. The machine is driven by a motor running at 500 to 1,500 r.p.m.,the spindle speeds range from 7.33 to 29.33 r.p.m., and the feeds range from .014 to .085 inches. The material operated upon is steel with a large percentage of nickel.




HORIZONTAL CHORD BORING MACHINE.

## AUTO HUB BORING AND REAMING OUTFIT.

THIS boring and reaming outfit does ten operations, at two "chuckings." A recent change in construction (see cut) of the Kelly Reamer, gives a more "rear" location of blades, which allows, without removal of bar side

Auto Hub Boring and Reaming Outfit.

plates, the quick exchange from boring reamer body to floating reamer, giving, as in cylinder reaming, finish and size to a "ten thousandth," and entirely eliminating "scrap hubs" through "non-fits" of ball or roller bearings.

This tool is manufactured by the Kelly Reamer Company, of Cleveland, Ohio.

## THE TRAINING OF AN ENGINEER*

By S. W. Barnaby, M. Inst., C.E.

THIS is a subject upon which there exist very great differences of opinion among engineers themselves. There are many who disparage technical training altogether, and who think that the sooner a boy can enter the shops and get to practical work the better; that he cannot, in fact, spare the time necessary to become a college graduate, and that it is not necessary for him to do so, because he will be able to pick up all the technical training that will be of any use to him during the period of his apprenticeship.

### Present Day Facts.

Now, this is not my view, and I believe it to be a wholly mistaken one. Many engineers in the past have, without doubt, done good work, and made large fortunes, who have had very little scientific training, but every year as engineering works advance in magnitude and importance, and as competition grows keener, the opportunities for the untrained man to compete successfully with the highly trained engineer will become less and less. Competition is so severe that in large engineering works, such, for example, as a big span railway bridge, material must be cut down to the lowest limit compatible with safety, to secure an order, and if overeagerness to get a contract leads an incompetent man to underestimate the material required, a disaster occurs, such as the failure of the Quebec Bridge over the St. Lawrence. Our engineers are now having to compete with very highly trained foreign engineers in all the different branches of the profession, and unless they are equally equipped, and I am afraid that at present they are not so as a rule, they will find it increasingly difficult to succeed. The idea that a lad entering the shops at the age of sixteen can learn all the things that should go to equip an up-to-date engineer by study in the evening is, I think, very unreasonable when you remember how trying the long hours are to a youth of that age.

### Curriculum Suggested.

A very influential committee, presided over by Sir William White, sat last year to consider the best course to pursue in the training of an engineer. The question before them was not whether a college training or a workshop training was the best, there was no difference of opinion on that point, the need for both was fully recognized, the only question was whether the workshop or the college should come first, and they recommended that there should be one year spent in the works immediately after school, then the complete college course, followed by three years' practical training. This recommendation no doubt represents a compromise between the views of those who think the workshop should precede the college and those who think it should follow it. My own feeling is that is easier for a boy to do justice to a technical course when it follows directly on his school work. I know from personal experience how difficult I found the college work after an interval of three years spent in the shops, and I am very glad the committee have recommended that only one year should be interposed between the two courses. I have usually advised any who have consulted me on the subject of their sons' training, to enter them for a college course after leaving school at 16, and, if possible, to let them spend six weeks or so of the long vacation between the closing of schols at the end of July and the opening of the University Winter Session at the end of September, in some engineering works.

The distinction of an engineering degree is the privilege of only a few men, but it is within the reach of all of you who make the most of your opportunities here. It will be worth your while to keep in mind a maxim which a friend of mine, an earnest and successful schoolmaster, has inscribed on his school buildings:—"I shall not pass this way again."

I do not wish you to understand that this is going to be your only opportunity for educating yourselves. Indeed, from one point of view your engineering education can only be said to be well begun when you graduate from here; but it is here that you will be provided with the tools with which to carve out for yourselves your own fortunes. A workman poorly equipped with tools makes but a poor show in the world's workshops. Here and now is your opportunity to possess yourself of a complete outfit with which to engage in your handicraft, and this opportunity will never, in the same measure, be yours again.

### Sir John I. Thornycroft.

Sir John Thornycroft commenced boat building at a very early age at Chiswick, being not much more than a lad when his father set him up in a small yard there. He built some very successful launches, faster than any of the small boats on the river at that time, but he soon made up his mind that he had not the technical knowledge necessary to enable him to carry out successfully the original work which he was ambitious to do. He, therefore, shut up his works and went off to Glasgow University to study under Professor Rankine. There he met a student who became his partner shortly afterwards, Mr. John Donaldson, who had also relinquished an appointment and sold all his property in order to go to the University. When Mr. Thornycroft returned to Chiswick after the completion of his college course, he felt competent to engage in the bold pioneering work with which his name will always be associated, and, it is not too much to say that no better equipped young naval architects and marine engineers were to be found in the country than John I. Thornycroft and John Donaldson when they commenced the building of torpedo boats in the seventies.

You must make up your mind what tools you want in order to fully equip yourself as an engineer. Now, what is an engineer? I will give you some definitions, which are all of them good.

Tredgold, nearly a century ago, defined engineering as "The art of directing the great sources of power in Nature for the use and convenience of

*Part I of abstract of an address delivered before the Hartley College Engineering Society.

man." This is a definition it is hard to improve upon, and it is incorporated in the charter of the Institution of Civil Engineers. Another definition states that "Engineering treats of the intelligent direction of the laws governing matter, so as to produce effects which will reduce to a minimum the time and physical labor required to supply all the demands of the body of man, and leave more opportunity for the exercise of the mental and spiritual faculties."

Still another writer defines it as "A combination of science and art by which all strictly material productions that involve construction, either directly or indirectly, and which are serviceable to mankind, are evolved, designed and materialised." Someone who believes in short definitions has said, "An engineer is a man who 'does' things." I suppose this writer would seek to differentiate him from the theologian who "thinks" things, and the author who "writes" things, the lawyer who "says" things, and the doctor who "guesses" things! But short definitions are always incomplete, and in my opinion to be a thoroughly good engineer you want to be able to "think" things, to "write" things, to "say" things, and to "guess" things, as well as to "do" things, and to do all these well. To be a good engineer you must know something of everything and everything of something.

### The Tools.

We were speaking just now of tools. I am not going to dwell on the essential ones, such as mathematics, mechanics, physics, natural philosophy and chemistry; you know without my telling you that you must have these in your outfit, especially the first, but put down in your list of the tools that will be useful to you the acquirement of a good style of writing. You will be called upon to write reports upon some test, or experiment, or piece of field work. It is not only necessary to express yourself clearly and tersely, but it is useful to write a good legible hand and good legible figures, and not to forget the importance of correctness in spelling. Just when a man is trying to get his start in life, a little thing like a good style in handwriting, and ability to write a business-like letter, may just turn the scale in his favor when he is being weighed against a number of applicants personally unknown to those who have to make the selection.

Should you have occasion to make application by letter for a post as draughtman, assistant manager, surveyor, or the like, let your letter be a plain, simple statement of what you have done, and do not always seek to make out that you have been in charge of the particular piece of work upon which you have been engaged unless it is an incontrovertible fact. It may happen that the person to whom you are writing knows the man who really was in responsible charge, and your exaggerated pretensions will then make a bad impression.

### Your First Position.

When you get your start in an engineer's office after graduation, try to show your employer that you are interested in your work, and do not work with one eye on the clock. Nothing gives a worse impression of a young man's capabilities than a want of keenness in his work. Again, a young college graduate will often find himself in receipt of pay a good deal below that of some of his colleagues whose scientfic attainments are much inferior to his own, yet whose ability to get out rapidly detail drawings for the shops makes them for the time being the more valuable men in the office. The technical school man is, in fact, handicapped on his first entrance into the drawing office by his want of practice in the routine work of an office, and he must not expect to earn so much for the first few years as the men who have spent the years at the drawing board which he has spent at college. He must do his best to make up for lost time in this respect, and have patience to wait for the opportunity which is sure to come in time, when his special training will bring him to the front.

### Acquirement of Foreign Languages.

You will find that a thorough acquaintance with a foreign language is a very useful thing to have. If I may introduce for a moment a personal note, I will tell you of an experience of my own. When I was an apprentice I read a speech by Robert Lowe, then Chancellor of the Exchequer, in which he strongly advised young men to acquire thoroughly the French language by reading French literature and French newspapers. I made up my mind to try and do so, and I owe to this my first opportunity for promotion, as I had only been a few months in Messrs. Thornycroft's drawing office when someone was needed to go to Cherbourg to run the trials of some torpedo boats. The man whose business it was to do this was needed elsewhere, and my knowledge of French helped to secure my selection.

### Press and Society Contributions.

A student or young associate member of engineering institutions may make a useful addition to his pocket-money by contributing to the proceedings abstracts from the technical press of foreign countries with the language of which he may be familiar. Besides keeping him abreast of what is being done in other countries, this is excellent practice in composition. There are many men with a thorough knowledge of their particular subject who are unable to write about it in good English, and are severely handicapped in consequence.

Do not seek to specialise too soon. You can never tell in which direction an opening may appear for you. Be just an engineer ready to turn your hand to anything within your scope, and my advice to you is not to expect to jump right into the berth for which you consider yourself to be the best suited as soon as you graduate. Take what offers so long as it is something into which you can throw a whole-hearted energy. It is always easier to get a better berth when you already have something than it is to find one when you need it badly. I am not advising you to be a rolling stone, because rolling stones generally roll downhill, but the great thing is to get going, jump on to the train somewhere, if it is only in the third-class, and trust to being able to get along to a more comfortable seat afterwards.

## DURABILITY OF BALL BEARINGS.

A REMARKABLE record of the service of ball bearings was recently shown by an investigation made by a prominent consulting engineer. Two ball bearings made by a company in Philadelphia were installed in one of the journal boxes of an electric car of the Atlantic City and Shore Railroad, which runs over all the street railway lines in that district, and after 3½ years' service, when the car had run about 150,000 miles, the journal box and its two bearings were removed for measurement. It was found that the mean or average radial freedom was 0.000046 in., or practically nothing, and the mean end play was 0.00125 in. The mean or average eccentricity of the inner race was found to be only 0.00004 in. also practically nothing. The mean radial freedom for the second ball bearing was found to be 0.0003 in., the mean or average end play 0.0097 in., and the mean or average eccentricity of the inner race 0.00025 in. The larger wear shown in the second bearing, small though it is, is accounted for by the fact that this particular bearing had to take the end thrust of the axle. It appears that during the 3½ years of service no attention was required, other than the supply of grease every 10 or 12 months. It is also understood that owing to the fact that the axles did not have the customary end play there has been a distinct reduction of flange wear, with the result that there is little or no shock on entering a curve, while the side sway is diminished.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## INDUSTRIAL EDUCATION OF FOUNDRY APPRENTICE.*

By J. W. Horne, B.Sc. ...

IN the days when trade guilds were in existence (11th to the 16th century), the term "apprenticeship" signified not only practical training in a particular trade, but also training of character and intelligence, without which it is impossible to become a really efficient craftsman. In those days, during the period of apprenticeship a youth received such an education as trained him how to live, while at the same time fitting him to become an intelligent workman capable of earning sufficient to provide for the necessities of life. It is not the purpose of this paper to trace the changes which have taken place in the intervening centuries. Anyone who is interested in the subject will find considerable food for reflection in the contents of a book on the subject by Reginald A. Bray. He defines an apprenticeship system worthy of the name as having to satisfy three conditions:—

I.—"Adequate supervision for boys up to 18 years; which must take into account conduct and physical development.

II.—Must offer opportunities of training both general and special; that is, the training of the citizen, and the training of the workman.

III.—Provision of a suitable opening on completion of apprenticeship."

### Purpose of Paper.

This system is ideal and if ever considered, is bound to lead to considerable controversy, but no one will deny that every effort should be put forward. No system of industrial education of the apprentice can be effective unless it gives him the capacity for becoming an intelligent workman, a healthy citizen and a good neighbor. The main purpose of this paper is to awaken an interest in the training of foundry apprentices, and to give in concentrated form an account of how the question is being tackled in some countries from which information can be obtained; to open up the whole question by discussion and to afford an opportunity of giving a definite lead to the council of this association as to what action should be taken in order that foundry apprentices may receive an industrial education fitting them to become not only intelligent molders but also healthy citizens.

*Abstract of paper read before the British Foundrymen's Association, August, 1912.

The problem of the more efficient education of the engineering mechanic has during late years had the serious consideration of many industrial firms, with the result that considerable progress has been made; but so far as information can be obtained, no great development has taken place in improving the educational standard attained by the foundry apprentice, although the problem has not been neglected by foundry employers.

Perhaps, the main reason why development in their case is, and has been, so slow, may be associated with the fact that as a trade, molding is generally held in low estimation. Though not the most mechanical of the trades, it must be remembered that a mold, to give a sound casting, requires more than the mere force necessary to ram the sand. There are a hundred and one things the molder must know and consider.

### The Trade at Fault.

Molders may have themselves to blame for this condition of affairs; in the first place, because only an inconsiderable number of them have done, or are doing anything to increase the esteem in which the public hold the trade, by increasing their respect for themselves. In the second place, practically comparatively few molders put themselves about to study the underlying principles involved in the molders' art, or do anything to raise its status in the mechanical world. There can be no question that foundry work requires a considerable display of mechanical ability as well as a sound knowledge of the physical properties and composition of materials used, yet, although machinery is taking the place of mechanical skill of the individual in most industries, this cannot be said of the foundry, as no great advance has been made in dispensing with hand molding.

Great mechanical ability is required to make a man a reliable and good molder, and to prove this to the world should be the aim of every molder.

### Molder Apprentice Intelligence.

One effect of the low estimation in which the trade is held by other tradesmen and engineers in general has always been evident in the poor supply of apprentices with a standard of intelligence equal to that of those entering other trades, especially engineering. While the age of the apprentice entering as a fitter or turner has been raised almost generally to 16, with a resulting advantage, the starting age for the foundry is 14. This means that the boy starts handicapped with a less developed intelligence and at an age when factory life will have a greater deteriorating effect. No doubt much can be done by inducing these foundry boys to attend evening continuation classes; but the good derived from them can only be limited, after a strenuous day in the shop. Perhaps, there is no department in an engineering works in which apprentices can be kept constantly employed.

The conclusions to be drawn from the above, with regard to lack of progress in intelligent and industrial education among foundry apprentices, is that it is due to the early age at which they leave school to enter an apprenticeship. Strenuous shop work and want of sufficiently developed intelligence at school prevents real progress at continuation classes. The first important duty, then, which would appear to devolve upon us, is to consider how best to raise the standard of the trade in the eyes of the public, so that the apprentices entering the foundry may be, as regards intelligence, equal to, if not better than those entering other trades.

### Foundry Apprentice in Germany.

In Germany great attention has been and is being paid to the industrial education of the foundry apprentice. Generally, the scheme follows on the lines laid down at the beginning of the paper. In its industrial life it is recognized that one of the most important requisites for the flourishing of an enterprise is a capable staff of workmen, the training of whom is one of the most important tasks of a manufacturing establishment. Many of the large employers maintain apprentice schools within the factory, schools which are of an intellectual and not a manual character. Apprentices, therefore, obtain a training in manual dexterity and skill under strictly apprenticeship conditions, along with intellectual work closely related to the shop work.

The advantages of an employers' apprentice school are the saving of time going to and from school, and the releasing of employers from the duty of supervising apprentices outside of shop hours. For those apprentices whose employers are unable to run an apprentice school, facilities on the same lines are provided by the municipalities. Lud-

wig, Loewe & Co., of Berlin, were the pioneers in the formation of an apprentice school some 10 years ago. A short account of their scheme will be of considerable value and interest.

**Molders' Practical Work.**

Sand cores, nine months.
Loam cores, six months.
Sand molding, twelve months.
Carpentry, three months.
Large sand molding, seventeen months.

**Loam molders' Practical Work.**

Loam cores, six months.
Carpentry, two months.
Small loam molding, twelve months.
Large loam molding, twenty-seven months.
Testing and trimming, one month.

**School Work.**

Two afternoons a week—one from 2 to 6, and the other from 4 to 6, extending over the whole period of four years.

**First Year.**—General intelligence, two hours:—The legal relations of the employers and employes; the rights and duties of working men; the history of Trade Guilds; the relationship of apprentices to the Guilds; accident and sickness insurances; Patent and Trademark law; citizenship; reading and correspondence. Drawing, two hours ; instruction in which is specialised for foundrywork. Arithmetic, etc., two hours.

**Second Year.**—Workshop, two hours:—Construction of a foundry; general arrangement; descriptions of the cupola, machines, etc.; lighting and heating; safety appliances; rules for the prevention of accidents; hygiene; comradeship; courtesy; order and peace; payment of and claim for wages. Drawing, two hours. Model drawing specially related to foundry work. Arithmetic, two hours. Exercises in lighting and heating; transport of raw materials; costing.

**Third Year.** — Raw materials, two hours:—Materials of construction; their production, classes, and properties; forging, rolling, etc.; properties and manufacture of copper, tin, zinc, etc., and their alloys. Arithmetic and geometry, two hours, with special reference to the foundry, model drawing.

**Fourth Year.**—Foundry Education:—Description of the various foundry tools; molding; casting; cupola practice, etc. Citizenship, one hour:—Constitution of the State; State revenues and expenditures; the rights and duties of citizens, etc. Drawing, two hours, with special reference to foundry work.

This short excerpt from the syllabus indicates that, while a considerable part of the time is occupied with work directly connected with the practical side of the foundry, the most important side of the education is the development of the true idea of citizenship and general intelligence.

**Industrial Education in United States.**

The American Foundrymen's Association, a number of years ago, appointed a committee to handle the question of industrial education. The chairman of this committee is Mr. P. Kreuzpointner, with whom this movement is an earnest lifework. He reports that the National Government must come to the relief of the industries in the matter of industrial schools, since it is seen more and more that the industrial education of all the workers—and not only a few of the best ones—has become a necessity to preserve the industrial standing of the nation. The States of New York and Massachusetts have made a beginning—mention in the case of Cincinnati will be made later.

**Definitions of Industrial Education.**

To make any plan of industrial education effective, there must be earnest good-will and co-operation of educators, manufacturers, business men, and the workmen themselves through their trades' unions. This industrial education must be used not only as a means of imparting mechanical skill, but also to raise the ideals of citizenship and act as a socialising agency. As an introduction to this paper, industrial intelligence was defined. It will be advisable here to expand it to the ideals of Mr. Kreuzpointer, who says:—

"The sum and substance of industrial intelligence, which should be one of the most valuable achievements of a broad industrial education, gives a man the power to see beyond the immediate performance of the operation at which he is engaged for the time being; the power to see the relation of his skill and the results of his work to the success or failure of himself and his fellow workmen; the power to see the intimate connection and interdependence between his careful or careless, his intelligent or unintelligent, honest or dishonest action and his personal welfare, the welfare of those depending upon him and the welfare of the community at large. Industrial intelligence includes some knowledge of materials; ideas of their production and cost; ideas of the organization of a modern industry; ideas of the nature and extent of the business of the country, and a sense of duty and responsibility, as a mechanic as well as a citizen. An education is of little value when rated only by a purely commercial standard."

Again, to quote the words of Mr. Thomas Burt; "I doubt whether the people of England have a sufficiently high conception of what education really means. The general idea of getting on is to make a fortune. That is a poor conception. Would they be willing to be millionaires if their intellect had to be dwarfed and their souls blighted?"

The foregoing quotation from Mr. Kreuzpointner's report goes to show that Americans are going on the lines of Ludwig, Loewe & Co. In an address to the National Education Association Convention, San Francisco, in 1911, Mr. Kreutzpointner pointed out the aims and tendencies of industrial education in Europe, referring specially to Germany, as the result probably of a visit to Dr. G. Kerschensteiner, superintendent of the Schools of Munich, whose reorganised schools are justly attracting the attention of the industrial and educational world.

**Progress Being Made.**

Mention has been made regarding the system which has lately been put into operation at the University of Cincinnati for the production of foundrymen. The system is briefly as follows:—

(1)—Careful selection of high average quality of raw material by university and shop.

(2)—Students work at the university and shop on alternate weeks.

(3)—Students grouped in pairs; members alternate with each other in shop and university; both shop and class rooms are thus always manned.

(4)—Student does same class of work as a regular apprentice, and under same shop discipline. If expelled from the shop, he ceases to be a student of the university.

(5)—The student is paid for his work in the shops.

(6)—A shops' schedule is arranged between the University and shop authorities, and in accordance with this, a student is moved forward through the various departments of the shop.

(7)—Students' school work is identical in standard with that given in all high-grade engineering schools. The shop instruction and certain laboratory courses, which would be but a duplication, or rather a poor imitation of the experience the boys are getting in the shop, are omitted.

(8)—The course is five years in length.

In the opinion of Mr. Porter, who has charge of this work, the most interesting and valuable features of this course is the shop co-ordination work which has for its object the taking of the blinders off the boy, helping him to see the real meaning of the operations going on about him in the shops, and giving him an excellent benefit from shop experience. For example, if he has been on the cupola platform, the subject of pig-iron may be taken up, while at another time, the theory of the cupola may be explained, and so on. An effort is also made to introduce the student to the best literature of the foundry.

## DRY-SAND MOLDING LARGE "T" CASTING.

By J. H. Eastham.

TWELVE turbine castings of "T" type, technically termed "nozzle bodies," were recently ordered at short notice. To save shop room by using a smaller cope, and to accommodate the horned branch indicated in Fig. 3, the two similar sides being bolted together. Seventeen bars were then cast from a template, altered to suit the pattern from the small end onwards and bolted to place over the pattern and joint with little or no trouble. The cope was next rammed up, hoisted off, finished, blackwashed, and placed on the stove car for one night's drying, whilst the drag part was finished and dried; three charcoal fires being lowered into the mould for the purpose. The core arbor arrangement, designed to last until completion of the order, was strong boxed-out type, the main branch piece being wedged to the body by a square socket device. The cost of rigging was, thereby, considerably reduced.

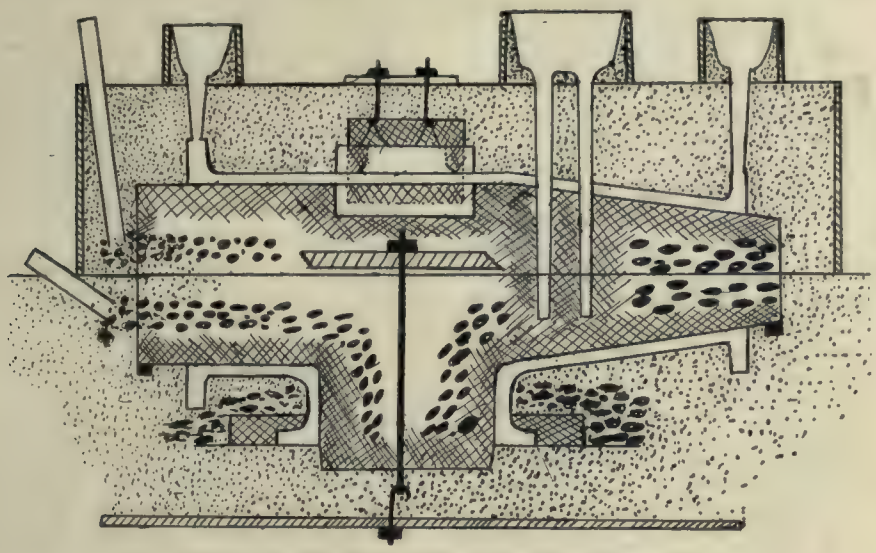


FIG. 3—SECTIONAL VIEW OF CLOSED MOULD.

Fig. 3 is a sectional view of the closed mould, showing runners and risers, with method of bolting down the main core to the permanent grating in the foundry floor, also the branch core secured to the cope; whilst Fig. 4 (end view), explains the binders employed to secure the mould when ready for pouring.

piece, weighing 8,000 lbs., was moulded with the main branch downward. A pit was opened at the correct depth, and a bed levelled, on which the branch coreprint was laid, rammed up, and strickled off; the core forming the flange (shown at Fig. 2), being next set to position. The lower half of the pattern was placed with the large branch through the aperture in the flange core, a pair of semi-circular gratings being laid over the core to prevent risk of breakage whilst ramming under the body, after which, the job was rammed up to the joint in the usual way.

The upper half of the pattern was now placed over the lower, and the cope built up round it, two flanged ends and

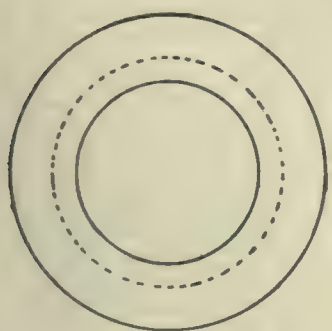


FIG. 2—FLANGE CORE.

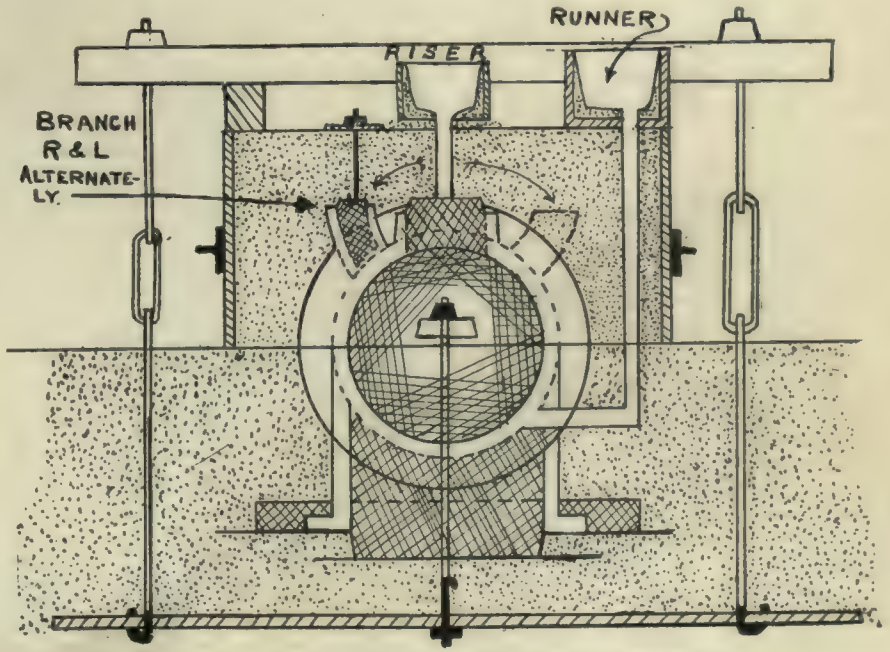



FIG. 4—END VIEW, SHOWING MOULD BINDERS.

## ORNAMENTAL ENAMELLING.

ORNAMENTAL enamelling has been practised in the East from a very early period. Among historical nations, perhaps precedence in the art might justly be assigned to the Egyptians, the fathers of so many arts and sciences. The famous blue enamel, or, more properly, glaze, of which many fine examples remain, seems to have been produced with a copper oxide, and the process was employed at least as early as 1600 B.C., if not earlier. Enamel—from "esmail"—has for a basis a fusible and colorless glass, which is rendered opaque and colored by the use of metallic oxides. These substances, having been fused and cooled, are thoroughly powdered and washed before being applied to the surface to be enamelled. The whole is then fired.

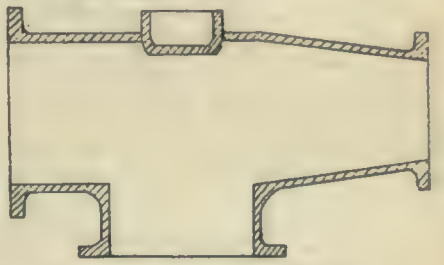


FIG. 1—TEE PIECE SECTION.

## SIDELIGHTS ON INDUSTRIAL EFFICIENCY*

By H. L. Gantt.

THE word "Efficiency" is being used somewhat to excess. A great many people write and talk of efficiency who do not seem to have a clear conception of what the word means. It is the special business of the engineer to study efficiency, but the fact that a man styles himself an "efficiency engineer" is not necessarily a recommendation. Recently, a man prominent in the industrial field stated that it seemed as if everyone who had failed at everything else was advertising himself as an efficiency engineer.

Now, it is possible to be entirely in sympathy with bona-fide efforts to increase efficiency without being in sympathy with all this talk about it. A society has recently been formed for the promotion of national efficiency, and has spent some time trying to find a definition of the word. What we want is not necessarily a change in methods of work, but to do our work thoroughly. The author's work has sometimes been criticized because it is said to have been done too thoroughly—he goes too much into detail , etc. However, any work which has anything to do with engineering must be done thoroughly.

### Fundamental Ideas.

With regard to industrial efficiency, it does not seem to be necessary to present a great many ideas; but it is necessary that the fundamental ideas and causes be clear. Some time ago, the financiers of the United States thought that they had solved the industrial problem through the great economies made possible by consolidation into huge combinations. Large trusts were formed, and it was believed that by eliminating competition it would be possible to manufacture and sell a great deal cheaper than had been possible in the past. These expectations, however, do not seem to have materialized, because the continually increasing cost of living seems to indicate that we need something more than able financing to round-out our theory of industrial economy. This has been a growing conviction on the part of students of our economic conditions for several years, but the most critical were not prepared for the admission, before the Interstate Commerce Commission, in November, 1910, by some of the most noted railroad financiers of the country, apparently seconded by Mr. Morgan himself, that they had done everything possible to reduce the expense of operating railroads, and that from now on, the public must accustom itself to increasing freight rates. These financiers thus admitted that, in the branch of industry in which the financial man is perhaps more nearly supreme than in any other, and in which competition has been practically eliminated, rising costs forced them to ask the public to bear a portion of their burden.

### Production Cost Feature.

The student of economics asks if there is not something lacking in our system of industrial economy that make such requests necessary or even possible. If it is a fact that in any branch of industry every possible economy has been effected, and that in the future, costs will be higher, we are confronted with a very serious condition, the far-reaching effect of which it is hard to foresee. It has been our boast in the past that with our labor-saving machinery and our improved methods, we had so reduced costs as to make the luxuries of to-day the necessities of to-morrow. If in any branch of industry, we are forced to acknowledge that costs will in the future be higher, are we not pointing to the time when these necessities will again be luxuries?

### The Financier View Inconclusive.

The statement, which happily few believe to be a fact, that in any industry the minimum cost has been reached, and that hereafter costs must be higher, is such a serious one, and fraught with such serious consequences to our industries at large, that many of us feel like asking the great financiers who are backing this statement to speak for themselves only, for there are many engineers who not only do not agree with them, but who believe there are means of increasing efficiencies and reducing costs, of which the financier has as yet no conception. These methods have been applied in isolated cases, and to a greater or less degree to a great variety of industries. They have produced a better and a cheaper product; and the workers are better paid and better satisfied.

In making this statement it is not intended to disparge the work of the financier, but to remind him that the civilization of to-day has not been built up solely by his efforts. In this process, the engineer and his able assistant, the skilled mechanic, have been even more integral factors than the financier, and until they hold up their hands and say the end is reached, that modern combination of engineer and mechanic, the mechanical engineer, respectfully asks that they withhold their cry of despair, and allow him to present what Mr. Brandeis calls his "Gospel of Hope."

### Modern Conditions.

Until a few years ago, all mechanical knowledge was empirical. It had been gathered by cut-and-dry methods through centuries, and was handed down with no written record. Yet it is wonderful what great progress has been made. The master workman of a century ago was justly proud of his work and of the apprentices that went forth from his shop. With the perfection of the steam engine, which is the foundation on which our civilization is built, and which was the invention of a mechanic whose work has had a greater influence on the world than that of all the financiers that ever lived —with the perfection of the steam engine, the master workman obtained cheap power, and was enabled to increase the size of his shop. The increase in size of the workman's shop gradually developed the factory system of to-day, in which the foreman and workmen have no interest other than their daily wage, and where they are too often laid off without cause and without notice, to suit the plans of the owner. Is it surprising, that, under these conditions, their interest in the training of apprentices should lag, and that the foreman and workmen should take but little trouble to train men who will shortly become their competitors?

### Responsibility for Efficiency.

This, however, is not all. The owner too often puts all responsibility for the promotion of efficiency upon his superintendent and foremen, yet limits them in the wages they are allowed to pay, or the records they are allowed to keep. The records, as a rule, are sufficient for criticism, but not enough detailed to enable the foreman or superintendent to know where the inefficiencies are, or which of his men are most valuable to him.

In one concern, a man who had complete charge of all the cost records frankly avowed that he was not keeping these for the benefit of the superintendent. He was simply keeping them so that he would know what was being done; in other words, he was there to criticize, not to help.

He had a lot of clerks to help him do the work, and although he did not say so, this is what was in his mind:—Those records were to keep somebody from stealing something. In fact, there are too many records to keep somebody from stealing something, and not enough to help the man who has to do the work to do it right.

### Friction of Conflicting Interests.

Railroad presidents claim that the increase of wages necessitates increased freight rates, which, if granted, must necessarily, in a meaure at least, increase the cost of living. Thus, neither arbitration nor collective bargaining, on which we have placed so much confidence in the past, gives promise of any permanent solution of our difficulties, and the time seems rapidly approaching when the friction of conflicting interests will seriously hamper our further development. We, therefore, naturally, ask why these interests conflict. The answer is plain. Neither party has been willing to

*Abstract of an address before the American Society of Swedish Engineers, Brooklyn, N.Y.

consider the interest of the other. The employer has too ofen insisted on paying the lowest wage, regardless of the service rendered; while the employee, through his union, has demanded the highest wage regardless of what he gave in return.

**Unequal Allocation of Profits.**

I heard something, recently, that quite astonished me. I have heard the same thing from three or four persons; but the last time I heard it from a rather unexpected source. I have heard a number of men make the statement recently that the financier—the capitalist—was getting too large a percentage of the earnings of the increase in wealth. A man told me that a millionaire friend of his in Wall Street had made that statement to him. There is no question that within the last fifteen years a much greater percentage of the increased wealth has been harvested by those who already had wealth. The worker, the engineer, the producer, did not get the same proportion of it that he had gotten previously, and this is one of our troubles to-day.

**Labor Unrest.**

The very serious unrest in the labor world to-day is due to the fact that the workmen have made up their minds that they are going to get a larger percentage. Now, we have got to face that condition, by finding out what is the proper thing to do, and trying to do it as soon as we can. Such action will prevent what seems to be impending conflict, due to the fact that both employer and employee have disregarded the great principle of equity, which is the foundation of all harmony. In the commercial world it has long been recognized that transactions which do most to promote prosperity are those which are beneficial alike to buyer and seller. Does not the same law hold good in the industrial world in the purchase of labor? With the operation of such a law, the interests of the employer and employee become identical, and we have laid the foundation for their harmonious cooperation.

**Efficiency Impossible Without Equity.**

Having done this, we are ready for the next step—namely, the promotion of efficiency in the utilization of human effort. The progress so far made in this direction has in many cases been in spite of a lack of equity in the relations between the employers and employees. Consider how much faster progress could be made if all men were assured of an equitable return for their efforts. As a matter of fact, real efficiency is impossible without equity, for no man will continue to put forth his best efforts without a proper reward. The idea of doing work efficiently is comparatively new to people in general. It is only within very modern times that the best educated people have given any thought at all to the subject of physical work. The only serious subject requiring manual skill that was considered worthy of their attention previously, being that of fighting, or war. It was Sir Henry Bessemer's search for a stronger metal with which to make field guns that gave us Bessemer steel. Until within a few generations, it has been very much more important to defend the wealth you had than to acquire more than sufficed for your daily needs. Hence the importance of defense.

**Ambition an Incentive to Efficiency.**

The time has come, however, when a man no longer has to defend his property with his skill or life, and can devote his energies to acquiring a surplus for himself and family. The great majority of men are ambitious to secure such a surplus, and are willing to work efficiently and industrially if they can be assured of an equitable compensation. The precise method of compensation is comparatively immaterial, provided efficiency is rewarded and not penalized, as is too often the case.

**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**

**The Task Idea.**

In trying to find a means for uniting the interests of the employer and employee, the task idea was developed — that is, the idea of putting before each workman a certain task to be performed in a given time, assuring him his regular wages if he could not perform the given task, and promising him a suitable reward in case he was able to perform the given task in the given time.

One of the important points relative to this method, frequently called "scientific management," is that the reward or bonus must be great enough so that the workman will feel that he is fully compensated for the extra exertion required to do the task. The bonus is usually from 20 to 50 per cent. of the regular day rate. Task work does not necessarily mean more severe work, but it means more continuous work under more favorable conditions.

**Locating Losses.**

Another important point that should always be noted is, that having set a task, the responsibility for its performance, does not rest upon the workman alone. Every case of lost bonus must be investigated by the management, and the reason determined. It seems very difficult to get people to grasp that idea and to go to that trouble. If a man does not make the bonus, they seem perfectly willing and content to let him lose it, and pay little attention to him. This is a great mistake, and tends to discredit the system, while the man is discouraged. It may not have been his fault; the machinery may have been out of order, the appliances he has been working with may have been unsuitable, or the material may have been inferior in quality. All these reasons may have prevented him from performing his task.

Frequently imperfections and defects in material bought have been found, simply, by investigating why the workman has been unable to perform his task, yet that material may have passed inspection. If, again, when some workman is unable to accomplish his task, a capable man in whom he has confidence tries to find out what the reason is, he will feel satisfied, and try to earn his bonus the next day. Therefore, in the task system, next to the subject of the proper task comes the necessity of investigating every case of lost bonus and of determining the reason.

When a proper scheme of management is devised by which all the available knowledge is used to plan the work, and if the tasks are set in accordance, and the workman liberally compensated for the performance of the task, there is no question but that marked economy can be produced by this new method of management.

**Mr. L. J. Street**, vice-president of the Canadian Inspection and Testing Laboratories, and district manager in Toronto for the past eight years, is severing his connection with that firm to go with the Dominion Iron and Steel Co., Sydney, C.B., as assistant to Mr. J. P. McNaughton, general sales manager.

• • •

**Leslie R. Thomson, B.A., Sc.**, lecturer in civil engineering at the Univerisity of Manitoba, has resigned to accept a position with the Dominion Bridge Co., at Montreal.

## PARS FROM CURRENT LITERATURE

**Castor Oil.**—A few years ago castor oil was the universal lubricant in India for both internal and external lubrication, but as engineers became more enlightened on the subject generally, castor oil for internal lubrication was discarded. The principle reason why castor oil has been condemned for internal lubrication is the breaking up of the oil into several corroding acids when exposed to high temperatures. As a lubricant for external bearings, however, castor oil is still largely used, and the old school of mechanical engineers will not listen to anything against it. A temperature test, however, will very soon show that, owing to the high fluid friction of castor oil, the running temperature of a bearing lubricated with a hydro-carbon oil will be considerably lower than that with castor oil.

* * *

**Welded Lap Joints.**—In some tests carried out in Germany on welded lap joints in boiler plates, two hand-welded joints were made, one being carefully worked at the right heat and the other being overheated. Tests were then carried out on numerous specimens cut from the plates, so as to include the joints, and either side. Half the test pieces were annealed before testing, their elastic limit and ultimate strength being lowered thereby. This indicates that the unannealed plates were considerably hardened by over-straining during welding, and annealing relieves the internal stresses. The detrimental effects of burning were very slight. On an average, the strength of a test piece containing the joint was 0.99 of that of the plain plate annealed, and 0.98 unannealed. The proportion for the elastic limit was between 0.85 and 0.98. It was concluded that the ratio of strength of joint to that of plate may safely be assumed to be 0.8, instead of 0.7 as specified in the German regulations.

* * *

**Dust Explosions.**—The amount of coal dust necessary to transmit a dust explosion is about one gramme per cubic metre of air. Such a quantity is frequently found, especially where high speed haulage is used. The most direct way of obtaining safety is by preventing its formation, and this can be done at the start by the use, for example, of hydraulic power to bring down the coal wet, and by enclosing tubs as thoroughly as possible. It can be removed to some extent by brushing, or, much better, by a fan collector. It can also be kept down by sprinkling with water, or, a more recent suggestion, by the use of a binder, such as soap or caustic soda with water. In a mine with the coal dust either removed or fixed, the danger of a local ignition of gas spreading through the workings would be entirely removed. This would not, of course, lower the standard of electrical plant, for all the conditions which apply to safety against ignition extend to prevention of shock.

* * *

**Cleaning Boiler Flues.**—The question of cleaning boiler flues mechanically appears to be receiving attention in various quarters. Two installations of vacuum plant have been tried for cleaning the flues of Lancashire boilers. In these, the men go inside the flues and manipulate a nozzle attached to a flexible pipe. Again in some cases it might be possible to work the pipe from the outside by providing special doors in the brickwork of the flues. Experiments are being made by one firm in this direction, and doubtless if any demand is created for such plants they will be greatly improved.

* * *

**Starting Up Economisers.**—It has recently been pointed out that accidents occasionally occur during the operation of starting up an economiser early in the morning. A careless attendant, for instance, on starting will sometimes open to the full, the dampers in the economiser chamber, and so allow the whole of the hot flue gas to pass through the chamber, forgetting for the moment that the engines or turbines and the feed pumps have not yet been started up and that there is consequently no water flowing through the economiser. Under these circumstances, the enclosed water becomes heated, until eventually evaporation into steam commences. The level of the water in the vertical pipes then becomes gradually lowered, with the result that the upper portion of the pipes, being bared of water, suffer from more or less overheating. Further, the steam so formed, by coming into contact with the water on the boiler side of the outlet valve, when the latter is opened, tends to cause "water hammer" action. This "water hammer" action causes crackling in the pipes, and it has in some instances led to fracture and explosion and serious injury to the engineer-in-charge.

* * *

**Economiser Explosions.**—The idea that an economiser is safe from explosion because it is only exposed to water pressure is probably due to the fact that vessels which have to be worked under steam or air pressure are invariably tested by means of water. The reason for so doing is that danger is eliminated of the parts flying violently asunder should any part fail,as would happen if steam or air were employed. There is, however, a great difference between an economiser under pressure and a steam boiler or other vessel under cold water pressure. In the latter case, in the event of any part of the structure failing, the pressure is instantly relieved, with very little increase in the volume of the fluid, and no great harm is done; in the former case much of the water in the economiser is usually at a temperature much greater than 212 deg. Fah., so that should the pressure be suddenly relieved due to failure of the containing vessel, a portion of the water would immediately flash into steam, the accompanying violent expansive force of which may cause entire disruption of the economiser.

* * *

**Steam Pipe Expansion.**—While the necessity of providing for expansion in long ranges of steam pipes is generally recognized, steam users sometimes overlook the importance, where such an expansion arrangement consists of a stuffing-box device and the ends of the length of piping are not anchored fast, of providing guard bolts to prevent the two parts being drawn asunder. The danger arising from the absence of such a provision is drawn attention to in Vulcan, and a failure is mentioned which occurred at a tinplate works a few months ago. There was a short length of pipe between the engine stop valve and the steam main leading to the boilers. The steam main and the short length were each fitted with a stuffing-box arrangement, but while that in the main was furnished with guard bolts, the short branch piece was not so provided, and when the pipes were put into operation, the two parts of the short length were drawn asunder, allowing steam to escape and scalding a laborer who was assisting on the job.

* * *

**Heat Value Specifications.** — In consequence of the increasing use of heat-value specifications in buying and selling coal in the United States, a demand has arisen for similar specifications to govern the purchase of fuel oils, and the Bureau of Mines has issued a pamphlet on the subject. "These specifications, to be satisfactory," says the author, "should establish not only the heating value of the oil, and thus show, like the specifications for coal, the number of heat units the purchaser obtains for a given price per unit quantity of fuel, but also the physical character of the oil, its flash-point and burning-point, and the quantity of extraneous matter it contains." The specific gravity of fuel oil, it is stated, should range from 0.85 to 0.96 at 15 deg. Cent., and the oil should be rejected if its specific gravity is above 0.97 at that temperature. It should be mobile, free from solid or semi-solid bodies, and should flow readily at ordinary atmospheric temperatures and under a head of 1 ft. of oil, through a 4-in. pipe 10 ft. in length. It should not congeal nor become too sluggish to flow at 0 deg. Cent., and should have a calorific value of not less than 10,000 calories per gramme (18,000 B.Th.U. per pound); 10,150 calories to be the standard.

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HAMILTON, ONTARIO

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Weston, Ont.**—A new steel foundry is about to start here according to report received. No particulars are given out as yet.

**Brantford, Ont.**—The Keeton Motors, Limited, incorporated for $200,000, and backed by members of the Verity Plow Company, are about to commence operations here. The plant has 30,000 square feet of floor space and will have a capacity of 350 cars per year.

**Port Arthur, Ont.**—Alex. Fergusson, of Halifax, N.S., recently announced his intention of considering the location of a foundry for the making and repairing of boilers. Mr. Fergusson is well known in the East, having there conducted one of the oldest establishments of this kind.

**Edmonton, Alta.**—By the end of September the $25,000 machine shop and foundry which is being erected at Industrial Heights by the Western Foundry and Machine Company will be complete and ready for operation, and the building of stationary, gasoline and steam rotary engines will commence in Edmonton. Work on the construction of the plant is already well advanced, and by September 15, the contractors promise the building will be ready for occupancy.

**Welland, Ont.**—R. W. Knight, of the McClintic-Marshall Construction Company, of Pittsburg, and E. O. C. Kuhule, of the plant at Carnegie, have organized a new company to build a steel fabricating foundry here. Work will start at once, and by November it is expected to have a capacity of 600 tons of steel per month.

**Fort William, Ont.**—A machine shop for the manufacture of stookers or shockers is about to commence operation here. The promoters, the Hammond Stooker Company, have received a bonus of $12,500 from the city.

**Lethbridge, Alta.**—The Lethbridge Iron Works Company, Limited, will move their whole plant next spring from the present location on First Avenue to the industrial sites purchased by the city in 1910.

**Galt, Ont.**—Work is being rushed on the Victoria Wheel Works new plant belonging to Thomas and Hancock. The foundation of the machine shop is complete.

**Saskatoon, Sask.**—The Armstrong Manufacturing Company, of Waterloo, Iowa, manufacturers of well-drilling machinery and gasoline engines, will locate a factory and warehouse here sometime in the near future.

**St. John, N.B.**—The plant of the Wilson Foundry, owned by Hon. J. E. Wilson, and the plant of the Canada Brush Company, were destroyed by fire with a loss of about $100,000.

**North Transcona, Man.**—Arthur W. Humber and Company are about to commence work on the establishment of a foundry and manufacturing plant. The main product of the plant will be cast iron and steel articles. Gasoline engines, forges, and hoisting machinery will also be turned out.

### MUNICIPAL.

**Vegreville, Alta.**—The ratepayers here recently endorsed a by-law to raise $24,000 for advancement of search for natural gas.

**Chilliwack, B.C.**—The by-law calling for the raising of $30,000 to be used as a bonus to the McAdam industry received the assent of the ratepayers.

**Kindersley, Sask.**—The burgesses recently voted in favor of the raising of $90,000 for the installation of water and electric light systems.

**Nanaimo, B.C.**—The by-law calling for the raising of $50,000 for improvement of water system was recently sanctioned by the ratepayers.

**Belleville, Ont.**—The ratepayers have endorsed the by-law to raise $5,000 to provide a site for the Wood Chemical Company.

**Lethbridge, Alta.**—The ratepayers here recently endorsed the natural gas by-law.

**Township of Dereham, Ont.**—The burgesses recently endorsed the raising of $4,425 for the purpose of erecting a school house and public school.

**Georgetown, Ont.**—By a large vote in favor of the by-law recently submitted the ratepayers authorized the raising of $3,200 as a loan to the Georgetown Foundry Company.

**Orillia, Ont.**—The burgesses have endorsed the borrowing of $25,000 for the purpose of building sidewalks.

**Calgary, Alta.**—The City Council has passed a by-law which authorizes the raising of $400,000 to provide for the construction of a filtration plant.

**Gleichen, Alta.**—The sewerage and waterworks by-law by which $5,000 is to be raised.

**Saanich, B.C.**—The ratepayers voted in favor of the school by-law whereby $30,000 will be raised for school purposes.

**Ingersoll, Ont.**—Two money by-laws were of late, defeated by the burgesses. The by-laws provided for the raising of $57,000 for a sewage system, and $20,000 as a bonus to Thomas Waterhouse and Company.

**Victoria, B.C.**—The ratepayers endorsed a by-law recently submitted which provided and defeated the city hall by-law which called for the raising of $500,000.

**Pembroke, Ont.**—The ratepayers have endorsed the by-law authorizing the raising of $25,000 to be granted as a bonus to the Canadian Northern Railway. This is to be a divisional point for the C.N.R.

**Port Dalhousie, Ont.**—The Hydro-Electric by-law was recently endorsed by the burgesses. This will involve the raising of an uncertain sum of money.

**Streetsville, Ont.**—The by-law recently submitted to the ratepayers to raise $5,000 for additional fire protection was recently carried.

**West Vancouver, B.C.**—The ferry by-law which called for the raising of $30,000 to be invested in the Vancouver Ferries, Limited, received the endorsement of the ratepayers.

**Toronto, Ont.**—The city council passed a by-law which calls for the expenditure of $300,000 for a municipal abattoir.

**Wingham, Ont.**—A by-law to raise $8,000 for the erection of a new town hall was sanctioned by the ratepayers.

**Grand Forks, B.C.**—The burgesses recently endorsed the by-law to raise $16,000 by debentures for the construction of a reservoir.

**Moose Jaw, Sask.**—The by-law by which George White & Sons were to receive a bonus from the city was defeated by the ratepayers recently. This is the second time the by-law was voted upon, the vote on May 30th being insufficient to meet the two-thirds requirement.

**Prince Rupert, B.C.**—Three by-laws, aggregating $121,000, were recently passed by the ratepayers.

**Athabasca Landing, Alta.**—The ratepayers recently endorsed the raising of $80,000 re installation of waterworks, also the raising of $70,000 for sewage system.

**Welland, Ont.**—Crowland Township, which consists of Welland industries, passed five by-laws recently. These are as follows:—Granting fixed assessment to Welland Terminals; granting switching privileges to the Canadian Northern Steel Company; granting fixed assessment to Canadian Northern Steel Company; granting switching privileges to Welland Terminals; and granting General Securities gas and electric services.

**Moose Jaw, Sask.**—It is reported that the municipal Board of Trade are considering plans for the erection of a new office building suitable for their business needs.

**Niagara Falls, Ont.**—Messrs. Henry Hope and Sons, of Birmingham, England, have opened negotiations with the municipal council regarding the erection of a branch plant at this point.

### ELECTRICAL.

**London, Ont.**—The Bell Telephone Company took out a building permit recently for an addition to its present plant to the extent of $45,000. The new building will be of red brick, and situated at the north of the present building.

**Toronto, Ont.**—The nine-mile extension of the Toronto suburban radial from Weston to Woodbridge has been delayed, owing to the refusal of the iron foundries to accept orders for the bridges on short notice; thus the contemplated completion in October is put off till next year when the line will be in operation.

**Lethbridge, Alta.**—The rural telephone line to the west of Carmangay will be completed shortly. There will be twenty phones on this line which will be divided into two circuits—one with nine phones and the other with eleven.

**Cabora, Sask.**—The North Western Electric Company, of Regina, have been awarded the contract to install an electric light system in this town at a cost of $20,000.

**Peterboro, Ont.**—An explosion at the plant of the Canadian General Electric Company caused serious damage. The sub-station was partially wrecked.

**Salmon Arm, B.C.**—Tenders have been called for construction of the Power House and supply of the units for the electric light system to be installed.

### GENERAL MANUFACTURING.

**Penticton, B.C.**—Considerable headway is being made with the new cannery about to commence operations here. Four carloads of cans have been received, and everything is ready to commence. About sixty hands will be needed. The output per day will be about 10,000 cans.

**New Westminster, B.C.** Another new industry is about to commence operations here in the shape of a wagon factory. The company behind the movement is the North-west Wheel and Wagon Company, with head office at Bellington, Washington.

**Medicine Hat, Alta.**—F. P. Jones, general manager of the Canada Cement Works states that it is the purpose of the company to establish a cement plant here.

**Pembroke, Ont.**—A Hamilton firm is seeking aid of the towns in the erection of a box factory. The company is capitalized to employ 90 to 100 men if the town will grant a free site and exemption from taxes.

**St. Thomas, Ont.**—Deals have recently been closed with two firms. One, E. E. Donovan, of London, will start a shoe factory in return for a loan of $12,000, and the other, the Steel Grave Vault Company, of Gallion, Ohio, will erect a factory on a free site.

**St. Thomas, Ont.**—The St. Thomas Dehydrating Company has recently been organized here with local capital for the purpose of dehydrating and evaporating fruits and vegetables. A canning factory has been purchased from the Canadian Canners.

**Peterborough, Ont.**—The Canadian McIntyre Automobile Company is seeking to establish a factory here. The company is asking aid to the extent of $2,346. The question is now before the ratepayers.

**Pembroke, Ont.**—The Dunlop and Company firm, owing to lack of space, are enlarging their store by 1,000 square feet. This will enlarge the store to one third more than the present capacity.

**Brantford, Ont.**—Negotiations have been concluded here for the establishment of the Keeton Automobile Company, with a capital of $200,000. It will employ 200 hands and will commence operations immediately.

**Montreal, Que.**—Fire recently caused a loss of $100,000, when the box factory of Myers Thomas Company, of Granby, was burned. The insurance amounts to $54,000.

**Belleville, Ont.**—The Wood Chemical Company of Canada recently were granted a $5,000 site and limited fixed assessment for ten years on condition of the aforementioned firm starting $150,000 of buildings in three months.

**Haileybury, Ont.**—Plans and specifications are now about complete for the erection of a factory for the manufacturing of cheddite, by the Energite Explosives Company.

**Melfort, Sask.**—John F. Hansen, recently returned from England, where he raised $4,000,000 for Western development, intends to start a sugar beet factory here soon, and to build a plant next spring.

**Calgary, Alta.**—With the object of forming a company for the manufacture of tar paper, several local business men held a meeting recently. No definite results are known yet concerning the outcome of the meeting.

**Medicine Hat, Alta.**—Excavation work has commenced on the new mill being built here by the Medicine Hat Milling Company.

**Fort William, Ont.**—The Berlin Bedding and Mattress Company, of Berlin, Ont., are to start work on the erection of a plant, which received the sanction of the ratepayers at the last election.

**Calgary, Alta.**—The management of the Union Fibre Company, of Winona, Minn. U.S.A., will erect a branch factory in this city at a cost of $250,000.

**Niagara Falls, Ont.**—The management of the Visor Knitting Company, of Niagara Falls, New York, will, in all probability, open a branch plant at this point in the old armory building. Considerable alterations will be necessary to the building.

**Regina, Sask.**—A report states that the management of the Canadian American Egg Company will establish a branch plant in this city. The members of this company state that they have received from Denmark particulars of a system that will keep eggs fresh for a period of two years. Mr. Hammer is president of this concern.

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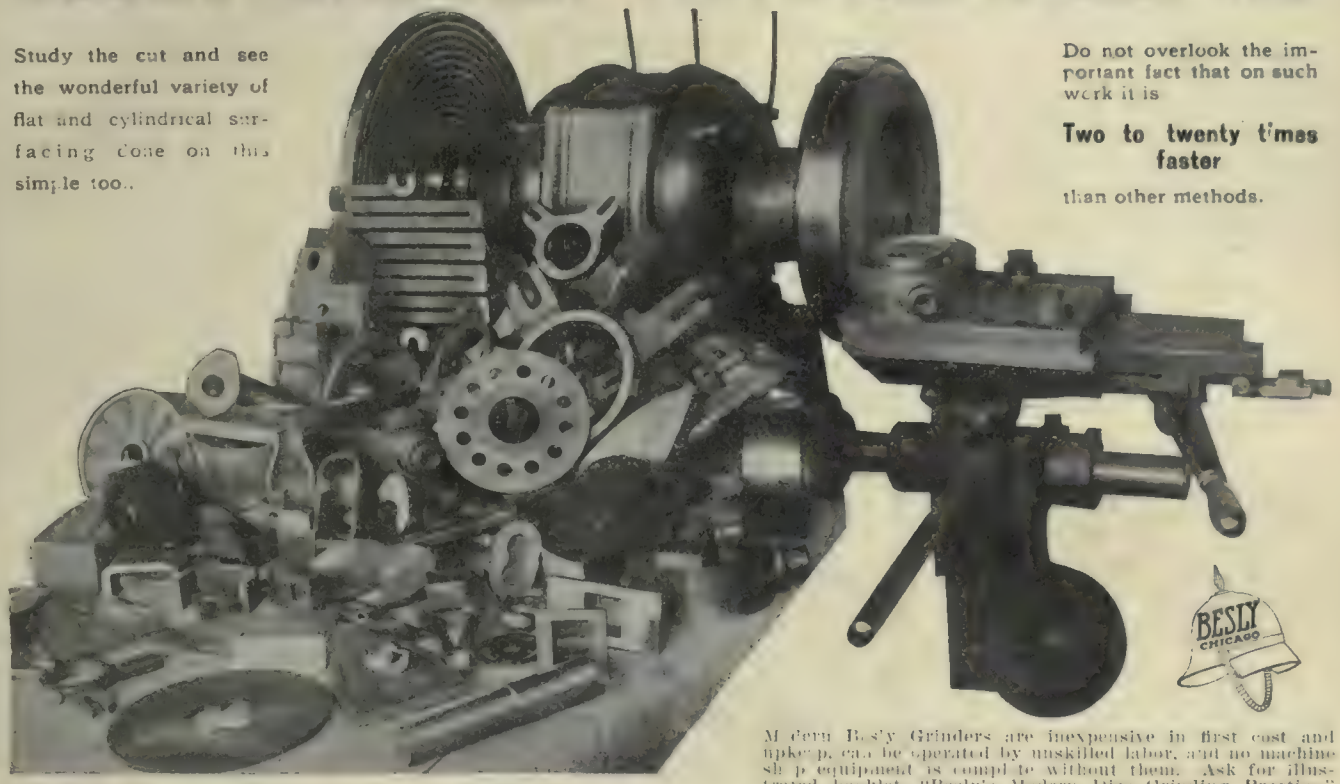


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TORONTO ST. JOHN, N.B. MONTREAL WINNIPEG VANCOUVER


**Coquitlam, B.C.**—The Call Switch Co., Coquitlam, B.C., has purchased a site at Coquitlam and will erect a manufacturing plant to cost $200,000.

**Coldbrook, N.B.**—The contract has been awarded for the construction of a new plant for the manufacture of automobiles, for the Maritime Motor Car Co., Ltd., at Coldbrook, N.B. There will be three buildings of brick and concrete.

**St. Catharines, Ont.**—The Ritter Illuminating & Mfg. Co., St. Catharines, Ont., will erect a new factory for the manufacture of electrical devices. G. B. Burson, St. Catharines, is manager.

**Galt, Ont.**—The Galt Furnace & Stove Co., Galt, Ont., will double the capacity of its plant.

**Toronto, Ont.**—The Central Garage & Supply Co., Ltd., Toronto, Ont., recently incorporated with a capital of $150,000, will erect a plant for the manufacture of automobiles and engines. Robert B. Haley and Royden J. Haley are interested.

**Oshawa, Ont.**—The Hacket Motor Co., Ltd., Oshawa, Ont., recently incorporated with a capital of $350,000, will equip a plant for the manufacture of motors and gasoline engines.

### PLANING MILLS AND SAW MILLS.

**Macleod, Alta.**—It is reported that Mr. Greig, the manager of the Standard Lumber Company, of Toronto, is about to establish here a new lumber and pulp plant. It is proposed to employ 200 men. Major Peuchen is head of the company.

**Belleville, Ont.**—Fire recently visited the sash factory of Peek and Wills here. The factory which was a large frame structure, was damaged to the extent of $20,000. The cause of the fire is unknown. Very little insurance was carried.

**Marysville, N.B.**—The Partington Pulp and Paper Company has started their mill in operation here. The sawing of the season's cut has commenced, and about 12,000,000 feet will be sent to the pulp mill at St. John.

**Melville, Sask.**—A sash and door factory is asking for a free site, power at cost, tax exemption, and a loan of $40,000, to locate a plant here.

**Montreal, P.Q.**—About $60,000 damage was caused by fire to the plant of the sash and door factory of Mr. Walter Reed.

**Newville, N.S.**—The buildings and plant of the Newville Lumber Company, were destroyed by fire with a loss of $20,000. This place is ten miles from Parrsboro.

**Hamilton, Ont.**—The Long Lumber Co., 28 James St., Hamilton, Ont., is planning to build a new box factory. The estimated cost is $150,000. Guy Long is manager.

**Guelph, Ont.**—The Guelph Carpet Mills, Guelph, Ont., are preparing plans for the erection of another large addition to their mills.

**Walkerton, Ont.**—The Canada Furniture Co., Walkerton, Ont., plans to double the capacity of its factory. Plans will be prepared at once.

**Granby, Que.**—The box factory of the Myers Thomas Co., Granby, Que., which was recently destroyed by fire with a loss of $150,000, will be rebuilt, and new machinery will be installed. Noted Aug. 22.

**Ayers Cliff, Que.**—W. Hunting, Massawppi, Que., will erect a new sash and door factory at Ayers Cliff, Que. Complete new machinery will be installed. Bids will soon be received.

**Edmonton, Alta.**—The Cement, Stone and Brick Co., Calgary, Alta., plans to establish a branch factory at Edmonton, Alta. Hiram Sykes is manager.

**North Battleford, Sask.**—The Union Supply Co., North Battleford, Sask., will have plans prepared at once for the construction of a large new flour mill. New machinery will be installed. W. Kloehm, Battleford, is manager.

**Dalhousie, N.B.**—The sawmill of the Sydney Lumber Co., Dalhousie, N.B., was destroyed by fire Aug. 18.

**Dalhousie, N.B.**—The shingle mill of Allen Hicks, at Dalhousie Junction, Dalhousie, N.B., was destroyed by fire Aug. 17. Loss, $6,000.

**Fairview, B.C.**—Fire destroyed Hatch Bros.' sash and door factory at Fifth Ave. and Cedar St., Fairview, B.C. Loss, $45,000.

**Port Hammond, B.C.**—The Port Hammond Lumber Co., Port Hammand, B.C., will build a lath mill in connection with its sawmill plant.

### BUILDING NOTES.

**Lethbridge, Alta.**—A monster convention hall is about to be erected here for the Dry Farming Congress. It will cover a space of about 200 square feet and will have a seating capacity for 2,500 persons. Further specifications are not made known yet.

**Montreal, Que.**—Plans are now about complete for the erection of a new warehouse for the Customs Department. It is to be built on McGill St., at a cost of $75,000, and will be seven storeys high.

**Rosthern, Sask.**—The Union Supply Company has started work on the new $25,000

flour mill here. The contract for the building which is to be 34 x 50 feet, four stories high, has been awarded to Sanderson and Thompson.

**Vancouver, B.C.**—The Vancouver Club to be built on Hastings Street is to be five storeys high and will contain excellent accommodation. There are to be three entrances to the building, all facing on Hastings Street. Messrs. Sharpe and Thompson are the architects.

**Regina, Sask.**—The new isolation hospital, and also a laundry and power house in connection with the general hospital, will be built this year. The isolation hospital is estimated to cost $55,000, whilst the laundry and power house will cost about $40,000.

**Nanaimo, B.C.**—The Canadian Pacific Railway is rapidly linking McBride Junction, near here, with Courtenay, in the Comot district. The contract for the construction of the same has been awarded to Messrs. Culleton Bros., of Spokane.

**Edmonton, Alta.**—The Royal Bank of Canada is erecting a new building on Jasper Avenue here. It is to cost about $100,000, and will be four storeys high. The structure will be fireproof throughout, being of steel with concrete and brick reinforcements. The front of the building will be adorned with six fine Corinthian pillars, having ornamental tops. Kenneth G. Rea, of Montreal is the architect, and Purdy and Henderson, Vancouver, the contractors.

**Vancouver, B.C.**—The plans for the proposed hippodrome which is to be erected at the corner of Granville and Pacific Streets here shows the building is to be of a very handsome structure. Plans for the interior call for sixteen private boxes and also every modern accommodation for comfort; vis., sitting-rooms, retiring-rooms, smoking-rooms, etc. The total seating capacity will be for 3,000 persons. The structure will cost about $500,000.

**Winnipeg, Man.**—The McCallum Hill building, to be built at a cost of $320,000 will be one of the finest of this city. It will be of steel frame construction, with tile partitions, and will be as absolutely fireproof as it is possible to make it. It will be eight storeys high with provision to carry two additional storeys.

**Calgary, Alta.**—Plans for the Government new immigration building shows it is to be 42 by 62 feet, and three storeys high. It will cost $50,000.

**New Westminster, B.C.**—The contract for the erection of the Royal Columbian hospital has been signed by Messrs. A. D. Rison and Dill, who were the successful tenderers for same at a price of $135,000.

**Calgary, Alta.**—Senator Lougheed has announced his intention of building another vaudeville house here at a cost of $100,000.

**Toronto, Ont.**—Hon. Adam Beck has announced the intention of merging his four box manufacturing plants which are established at Montreal, Toronto, Hamilton, and London, into one. This will henceforth be known as the Beck Manufacturing Company. The consolidation of these different concerns will cause the construction of a new building on Wilton Avenue, here, to cost about $600,000. A feature of this change is the introduction of a new idea of co-operation.

**Moose Jaw, Sask.**—Excavation is started on the new theatre to be built here. It is being built for W. B. Sherman, who has already ten theatres in the Canadian West; this one is to cost $150,000.

**Winnipeg, Man.**—The new seminary for "La Corporation Archiepiscopale Catholique Romaine de St. Boniface," is nearing completion and will be ready for occupancy in about six weeks' time. It is four storeys high, and will cost $125,000. J. H. Tremblay and Sons are the contractors and J. O. Turgeon, is the architect. The building is said to be one of the most magnificent in Canada.

**Vancouver, B.C.**—The contract for the building of the Dawson school has been let to the Canadian Ferro Concrete Company. The structure, according to the tender, will cost $122,000.

**Toronto, Ont.**—The plans for the experimental sewage disposal plant have been drawn and approved, and the construction of the same will commence at once.

**Wainwright, Alta.**—The contract for the erection of the new fire and town hall has been awarded at a cost of $10,000. Work will commence at once.

### MISCELLANEOUS.

**Calgary, Alta.**—The draughting department of the Canadian Northern Railway are in possession of plans for a proposed hotel to be erected in this city at a cost of $1,000,000.

**Edmonton, Alta.**—The Jesuit Order announces that it will found a college in this city. Father Jean and Hudon, of St. Boniface College, Manitoba, are in charge of the preparations.

**Edmonton, Alta.**—The municipal commissioners are considering plans for the erection of a new market.


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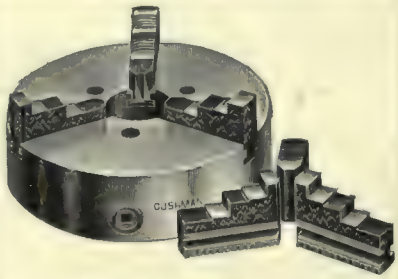


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**Montreal, P.Q.**—Messrs. Ashmore, Benson, Pease & Co., Ltd., of Stockton-on-Tees, England, have been given an order by the Montreal Light, Heat and Power Company to supply and erect at their Outremont station a four lift gasholder of 3 million cubic feet capacity and a steel tank to contain the same. The tank is 184 feet in diameter, and 31 feet deep, while the gasholder has four lifts and will be guided by steel lattice standards and girders. It is expected that work in connection with the erection of the tank will begin soon. The foundations have been prepared by the Montreal Light, Heat and Power Company. The Canadian-British Engineering Co., Ltd., of London, Eng., and Toronto, are the Canadian representativeh for Messrs. Ashmore, Benson, Pease and Co.

**Halifax, N.S.**—The Nova Scotia Car Works have received an order from the C.P.R. for five hundred steel box cars. The company recently just finished an order for 250 steel cars for that road.

**Galt, Ont.**—Messrs. W. D. Sheldon, J. F. MacGregor and Allen Hills, all of this town, are interested in a new project of the Hare Engineering Company. $400,000 of capital stock in this company has been taken up in Great Britain and the company will now erect a plant to manufacture power equipment and pulp machinery. The plant to be erected in this town will cost about $150,000.

**Kingston, Ont.**—The management of the Canadian Locomotive Company are about to erect several residences for the mechanics employed by them. Fifteen double houses are to be built before the winter months.

**Moose Jaw, Sask.**—The Moose Jaw Steam Laundry have taken out a permit for the erection of an addition to their plant. There will be considerable machinery necessary for the work to be conducted in the new wing. The cost of the building will be about $10,000.

**Montreal, P.Q.**—A large glass factory will be erected in Montreal West near the Canadian Pacific Railway's new yards. There will be about 600 men employed when this industry commences operations.

**Toronto, Ont.**—Sealed tenders will be received by E. R. C. Clarkson, at his offies, 33 Scott Street, Toronto, Canada, up to twelve o'clock noon, of Wednesday, September 11th, 1912, for the purchase of the Sheet Steel Mills and equipment, formerly owned and operated by The Canada Tin Plate and Sheet Steel Company, Limited, and The Canadian Sheet Steel Corporation, Limited, at Morrisburg, Ontario, Canada. Further particulars may be obtained from the above.

### CATALOGUES RECEIVED.

**The Newton Machine Tool Works, Incorp., Philadelphia, Pa.,** have issued Catalogue No. 47, dealing with the firms well known line of cold saw cutting-off machines. These are shown in all sizes for every variety of work. The catalogue is well printed and profusely illustrated. Parties interested are requested to mention No. 47.

**The Mesta Machine Co., Pittsburg, Pa.,** have issued an attractive little booklet illustrating their plant and some of its products. The latter consist principally of machinery for steel works, blast furnaces and power plants, consisting of gas and steam engines, barometric condensers, air compressors, steam-hydraulic forging and bending presses, rolling mill machinery, etc., etc. The only limit to the size and weight of machinery they build is that imposed by the limits which the railroads can handle. Castings weighing over 100 tons have been made in their foundries and finished in their machine shops. The booklet is well illustrated by a large number of half-tones, which give one an excellent idea of the extent of this large plant and of the heavy work there turned out.

**Bruce, Peebles & Co., Ltd., Edinburgh, Scotland,** have mailed us a pamphlet which they have recently sent out. This new pamphlet (No. 21B) deals with medium size self-contained type continuous current dynamos and motors. In the beginning of the publication is given a specification of the various types, while farther on are to be found ratings and efficiencies of the different frame sizes at standard voltages for protected, semi-enclosed, and totally enclosed machines. The pamphlet also gives approximate weights and dimensions of all the machines listed.

**The Smart Turner Machine Co., Ltd., Hamilton, Ont.,** have issued catalogue No. 8, an extremely well gotten up little book devoted to steam pumps, of designs and sizes ordinarily called for. The firm, of course, also build special pumps of all sizes and types to meet any conditions. Those desiring information on power pumps should ask for catalogue No. 7.

**W. Sisson & Co., Ltd., Gloucester, England,** have forwarded a bulletin descriptive of their jet condensing plants for power installations, with which they have been meeting with much success.

# Reciprocating Straight-Blade Sawing Machines

By Charles Wicksteed

*The writer of this article traces the history and development of Straight-Blade Sawing Machines, and, in addition to showing the extent of their useful and economical production application, indicates the direction in which further improvement is necessary, and sure to proceed.*

THE saw is one of the earliest tools known to have been used, and is in fact the earliest tool that has been traced in Egyptian history. It was first found in the form of a notched bronze knife (A), Fig. 1. in the 3rd Dynasty, or about 5,000 years B. C. It was followed by larger toothed saws in the 4th to 6th Dynasties, which were used by carpenters; but there are no dated specimens until the seventh century B. C., when the Assyrians used iron saws, as shown at (B). The first knives on record were made out of flint, and were in fact saws with minute teeth (C). They must have been used for cutting up animals, as the teeth would break away even on soft wood. Rasps, which are but a form of saw, were first made of sheets of bronze punched and coiled round, as shown in (D), but the Assyrians in the seventh century used the straight rasp made of iron exactly like the modern type (E).

Coming down to modern times, the saw is possibly more used than any other tool. It has taken three distinct forms, both for the working of wood and metal; the straight saw, which is simply a development of the first toothed knife, the band saw and the circular saw.

### Hack Sawing Machines.

The author proposes in this Paper to discuss the merits of the Straight-Blade Reciprocating Saw for metal work, and to point out that, although great pains have been taken to bring to perfection the Band and Circular type, curiously enough the Straight-Blade Reciprocating Sawing-Machine has been, comparatively speaking, neglected. The simple fact that, with few exceptions, the cost of Hack Sawing-Machines has in former years been only from $25 to $50 against a much higher cost for other types, fully attests the truth of this statement. Primitive blades sold at about 6 cents each and primitive machines sold for a few dollars were good enough for this system. The author thinks that it was the Millers Fall Co., Mass., who first brought out the hack sawing-machine, known as the "Star," Fig. 2.

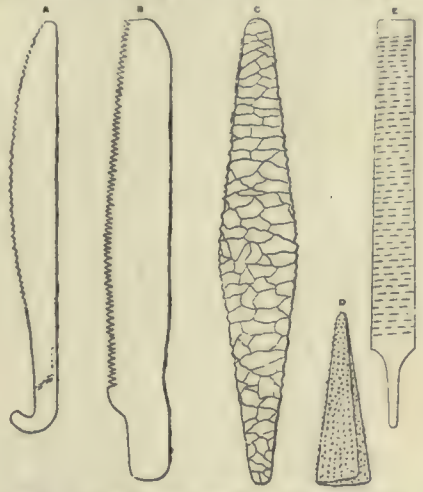


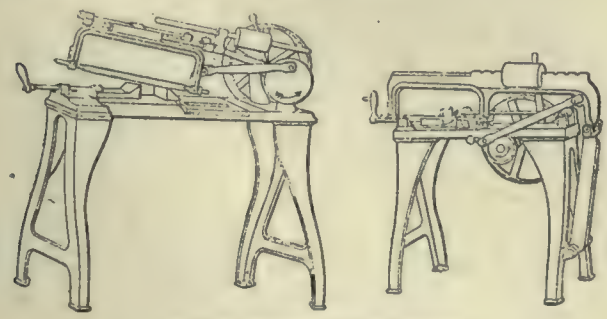
FIG. 1. ANCIENT EGYPTIAN TOOLS.
A—Notched bronze knife. 3rd Dynasty, 5,000 B.C.
B—Assyrian iron. 7th Century, B.C.
C—Flint knife.
D—Rasp made of bronze, punched and coiled round.
E—Straight rasp, iron, Assyrian. 7th Century.

This is the crudest and lightest possible device for working a saw backwards and forwards by power instead of by hand. It is not curious that a start should be made in this way, but the curious part is that this machine, in all its essentials and with all its faults, prevails up to the present time. The connecting-rod was made of wood, the old hand-saw bow has been maintained intact, and the guides were of the most elementary character

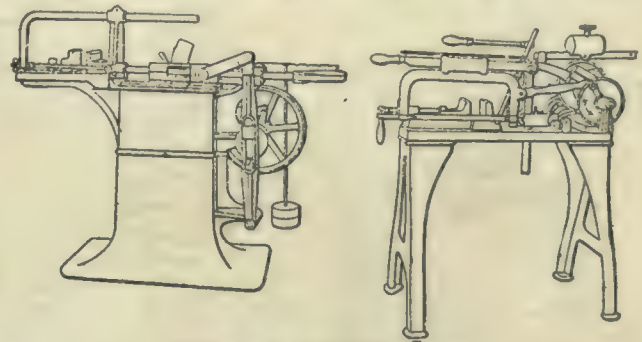
The next Hack Sawing-Machine introduced, was, the author believes, the style known as the "Simplex," Fig. 3. This is more elaborate and heavier, the old hack saw-frame giving way to something stronger. It was brought out by Mr. Hoefer and proved very successful. These two machines were the forerunners of all the present hack sawing-machines.

Another very early pattern of hack sawing-machine was the "Eureka," Fig. 4, which was made by Messrs. G. Thompson, Son and Co., of New Haven, Conn. This is a far more mechanical and carefully designed structure; it has a solid base, and a real attempt was made to guide the saw straight. The thrust is in direct line, and the upper guide capable of extension, so as to admit the large variation in length of blade being used. This was a magazine saw, a long blade like the band saw being coiled up and brought out for use as the working part became worn up. The coil contained 25 feet.

One of the latest machines brought out is the "Milford," Fig. 5. This is a carefully designed tool, and is in great demand. It is fitted with a quick return and a clutch device for lifting the blade free of the work on the idle or return stroke. It has a geared drive of 4 to 1, and an automatic stop. In the author's opinion, these four designs fairly illustrate the progress of the original type of hack sawing-machine up to a recent date, although many others might be mentioned, for instance, the "Racine," which is a compact and strong tool, and the "Marvel," a strong, complicated machine with a positive feed.



HACK SAWING MACHINES.
Fig. 2. Star. Fig. 3. Simplex.



HACK SAWING MACHINES.
Fig. 4. Eureka. Fig. 5. Milford.

### Steps Towards Larger Capacity.

Messrs. Herberts, of Manchester, were one of the first firms who seriously took the matter in hand, with the view to making altogether stronger machines for doing the work quicker and taking larger sections. They made saws

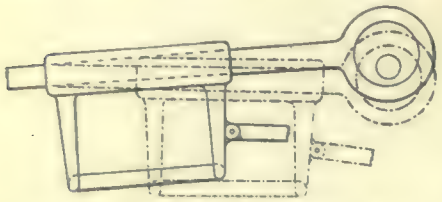


FIG. 6. ECCENTRIC MOTION FOR TILTING THE SAW.

of a capacity hitherto commercially unknown, the largest being capable of taking 18 by 30 inches. They also introduced, amongst other things, an automatic feed for the work, but the most important feature of their machines was the eccentric motion given to the fulcrum of the saw frame, shown in Fig. 6, where, every twenty strokes or so, the eccentric on which the fulcrum of the frame is pivoted moved around slightly thus putting the saw at a different angle to its work and bringing it on a very obtuse corner. By this means it was always working on a comparatively small surface, and it thus became much easier to saw heavy sections. The author believes that Messrs. Herberts were able to cut bars much quicker than formerly. For in-

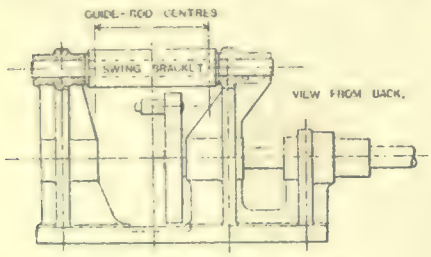



FIG. 7. FRAME BEARING.

stance, a 4-inch bar could be cut in 20 minutes, compared with an hour taken by most previous machines. The only disadvantage in this method is, in the author's opinion, that when first the eccentric is moved, the effect on the saw is rather rough, but as quick work is often of greater importance than too great economy in saw-blades, the merits of the machine were rapidly appreciated. The author thinks that this firm was the first to use a stronger and better blade, and they were backed up by the Stirling Co., who used tungsten-steel. Messrs. Herberts have recently constructed a tool in which the blade is set at an angle to the guides. This causes further pressure on the blade while cutting, and takes the place of the weight to that extent.

Messrs. Holroyd and Co., of Milnrow, also introduced an excellent machine for rapid work with the same object in view as Messrs. Herberts had, the difference being, that, in the case of the Holroyd machine, the bar turned round a little every stroke, thus presenting a small surface to the saw, as Messrs. Herberts did with their eccentric motion. The advantage of the Holroyd system was, that, since the bar was continually turning round, it was difficult for the saw to run, and the work would be approximately as true as that produced in a cutting-off lathe.

### Advantages.

(1)—The comparatively low cost of the machine and blade, and the fact that the blade can be made any temper to suit the work.

(2)—In comparison with the Circular Saw, it will cut any depth that the

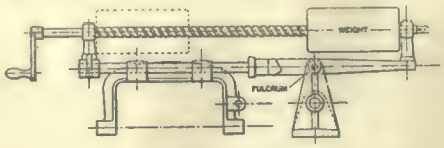



FIG. 8. MOVEABLE WEIGHT TO PREVENT VIBRATION.

frame, which holds it, will admit. Extra depth does not necessitate extra cost of blades, and it will cut any length within 6 inches of the length of the blade. A circular saw, taking the boss into consideration, will not make a cut much deeper than one-third of its diameter, and for every extra inch in depth the saw must be increased 2 and 3 inches in diameter. It is a most expensive and cumbrous tool, necessarily fairly thick and exceeedingly difficult, being nearly impossible to get quite hard, and, if made quite hard, is of course liable to break up.

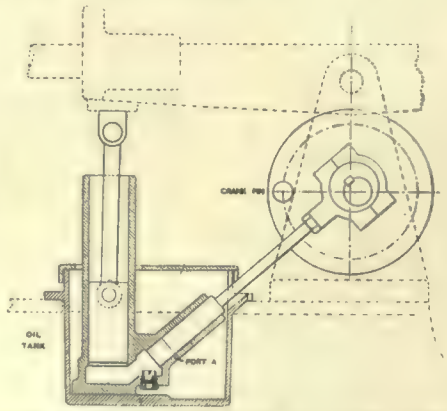



FIG. 9. PUMP AND RAM TO LIFT AND LOWER SAW.

(3)—In many cases the Band Saw must be cut in order to be threaded through the work, and, like the Circular Saw, is almost impossible to be got quite hard; moreover, it is dangerous to use if hard.

(4)—Another advantage of the straight blade over the circular saw or lathe cutting-off machine, is the narrowness of the cut, say 1-16 inch instead of ¼ inch. This, so far as the circular saw is concerned, at any rate

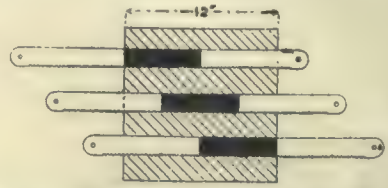



FIG. 10. THREE SAW POSITIONS.
Showing a saw of 6 in. stroke, cutting through a 12 in. block. The black portion is that which always remains in the saw cut.

reduces the power taken in exact proportion to the width to be cut, and in both cases it usually saves material enough to pay for the whole operation. That is to say, if the material saved by the narrow cut as against the wide one is taken into account at the end of the day, sufficient material will have been saved to pay for the whole cost of cutting including establishment expenses.

(5)—The power taken is about one-fourth of that taken by a circular saw. One unit will cut 80 superficial square inches, which is equivalent to eleven bars of 3 inches diameter or three heavy section girders, 20 inches by 7½ inches.

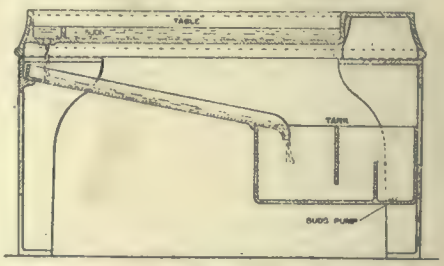



FIG. 11. PUMP AND TANK BELOW MACHINE.

### Principles of Construction.

When once convinced that the straight-blade reciprocating machine had great theoretical advantages over its competitors, the Circular Saw and the Band Saw, it did not take very long to discover the principles on which it must be made:—

(1)—The blade must be kept absolutely firm and perfectly square with the work.

(2)—It must be strong enough to stand all the weight that the teeth will take without breaking.

(3)—The blade must be made of the highest possible quality of steel with the best cutting edge that is practicable.

(4)—The machine must be well designed and work the blade without spring or vibration.

(5)—Since the pressure on the blade must be considerable, an absolutely reliable release on the return stroke must be provided. In connection with this, the author has found from experiments that, unless the weight was

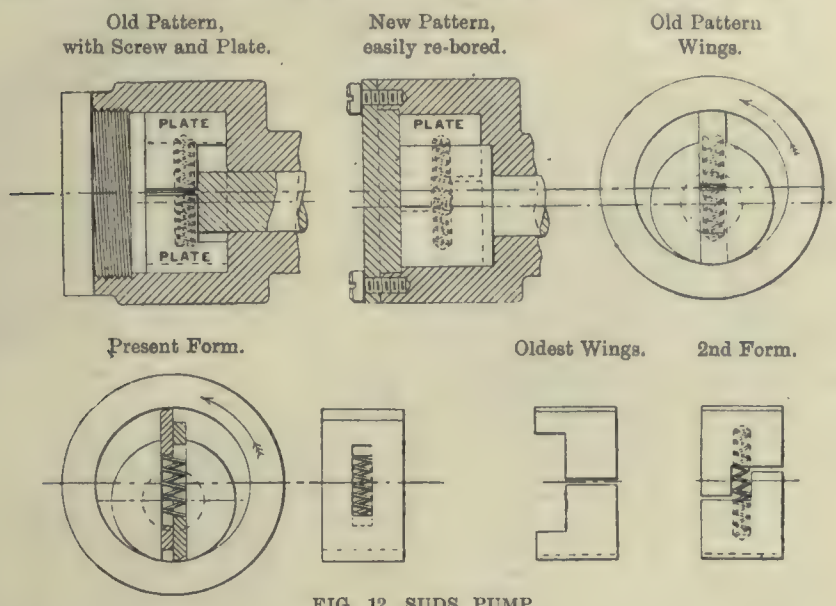



FIG. 12. SUDS PUMP.

heavy, it made little or no difference whether the blade was released on the return stroke or not, but with a very heavy weight the blade would be quickly destroyed.

**Established Features.**

Taking the points just mentioned seriatim, the blades have not been brought to the high quality now described without much trouble on the part of the makers, who have been kind enough to assist the author in this respect. The points which appear to be fairly established are:—

(1)—For ordinary work, the coarse-pitch tooth, not less than 10 to the inch, is the best. They cut better, they clear themselves better, and there is better opportunity to give side clearance, which is specially necessary in the deep blades necessary for heavy machines.

(2)—To make the blade strong enough to take the weight that the teeth will stand, it is not necessary to do any special tempering for this purpose. If the temper is right for the teeth, it is right for the back of the blade.

(3)—Extra strength must be obtained, not by extra thickness but by extra depth. Extra thickness does not help in any way. If the blade is 20 per cent. extra thick it requires exactly 20 per cent. more weight put on to get through the work in the same time. Theoretically, the thinner the blade the better, but in practice the deep blades must be made thicker for convenience of manufacture, because makers find it too difficult to harden deep thin blades absolutely straight, and it is evident that the deeper the blade the more difficult it is to keep the clearance. The blades used by the author vary from ¾ inch to 2 inches in depth and from 19 to 16 wire-gauge thick.

(4)—The greatest weight that a tooth will take without injury must be ascertained, and the blade must then be made strong enough to take it. This weight the author finds at present to be about 7 lb. per tooth or 70 lb. per inch. A weight of 210 lb. is therefore put on a 6-inch machine, which enables it to use practically the full capacity of the blade up to a 4-inch bar. As the machine gets larger, the proportion of weight is increased. Thus in a 15-inch machine, 700 lb. is put on, so that the machine will use the full capacity of the blade when sawing a 10-inch surface. The proportion is increased in this way because it is presumed that the 6-inch machine, for instance, will principally be doing smaller work, and that the larger machines are intended for large work which it is important to get through as quickly as possible.

**Design of Machines.**

After having said this much about the blades, it is hardly necessary to point out that a machine very different from those usually employed must be designed to work them. Most of the old designs were more useful as warnings than examples. In getting out a new design, the author's ambition was to make a Reciprocating Sawing-Machine in the form of a first-class machine tool on simple and sound mechanical principles that would utilize all the duty that a high quality straight blade was capable of taking. One of the greatest faults of the machines so far in use is, that, following the example of the first machine that was made, the guide-frame is almost universally pivoted on the crankshaft, generally by a narrow bearing, thus ensuring liberty to begin with, which daily increases with wear. In this way was the first essential of a good machine missing at the outset. With a loose guide, the saw would run, make bad work, and break the blades. To avoid this fundamental defect, the guide-frame is pivoted on perfectly independent bearings, substantial and wide apart. These bearings have no other work than to guide the frame, and there is practically no wear whatever, Fig. 7. It was found necessary to stiffen the machine in every direction. The bed was made much wider, a bearing being thus given for the bar on both sides of the saw, the guide-bars were placed wide apart, all the bearings brass-bushed and ample, and in the case of the larger machines a vice was provided on both sides of the blade.

Weights were increased until a 6-inch machine weighed 5½ cwt. and a 15-inch machine 25 cwt. These weights were found necessary to make the machine perfectly firm and free from all vibration. Since the weight used on the blade was so heavy, it became necessary to adopt a convenient method of applying this from zero upwards. This is done by sliding a weight on a bar which runs from the extreme end of the frame to a point well behind the fulcrum of the swing bracket, in which position it balances the weight of the guide-bars and frame. In the heavy machines, this weight is adjusted by a quick pitch-screw, Fig. 8.

Having such a heavy weight to deal with, it next became necessary to pre-

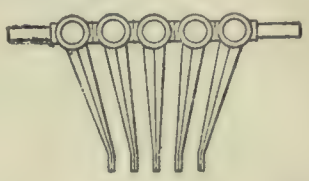
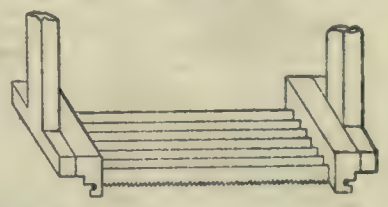


Fig. 16. For cutting blanks from ¾ in. thick up to capacity of machine.



MULTIPLE SAW.

Fig. 18. Rack arrangement for cutting blanks from 1-16 in. to ¾ in. thick.

vent the breakage of the machine in case the blade should break, and so long as the usual small boy was to manipulate the machine, it also became necessary to lift the weight by power. A perfectly reliable release was also required on the return stroke of the blade. This latter is a difficult or impossible thing to provide for satisfactorily by purely mechanical means, as the plane of the saw varies at every stroke, so that a rack-and-catch arrangement is unsuitable. The clutch principle used on some machines is also unsatisfactory, as it constantly requires a nice adjustment which is quite beyond the capacity of the boy in attendance. Experiments have shown that it is essential that the saw should be lifted off its work and put down again accurately at the extremes of the stroke. If this be not done, either the output is seriously interfered with or the blade is injured. Ultimately, to deal with all these points, a 4-function hydraulic ram (to be described later) was used on all the larger machines. This was first brought out in the form of the simple ram, as shown in Fig. 9. Here, an eccentric set in line with the crankpin on the crankshaft works a little plunger in connection with the dash-pot. This plunger comes down and closes the little port (A) exactly at the end of the stroke, thus gently lifting the frame sufficiently off its work on the return stroke and letting it gently down again, and, as soon as the working stroke begins, leaving the full weight on the blade. There are no complications and no wear in this device, as both pistons are simply made a good fit and work in oil. A foot valve is provided to let the oil in when the frame is lifted by hand. It was found to perform perfectly the function it was designed for.

Modifications were quickly followed to make it useful for other purposes. The port was made small enough to convert the largest cylinder into a dash-pot and thus made it impossible for the frame to fall, as it could only be lowered as fast as the oil could be pressed through the small hole, about 1-32 inch diameter in the case of the smaller machines. Soon after this, the ram was made to perform four functions by the introduction of a 4-way cock.

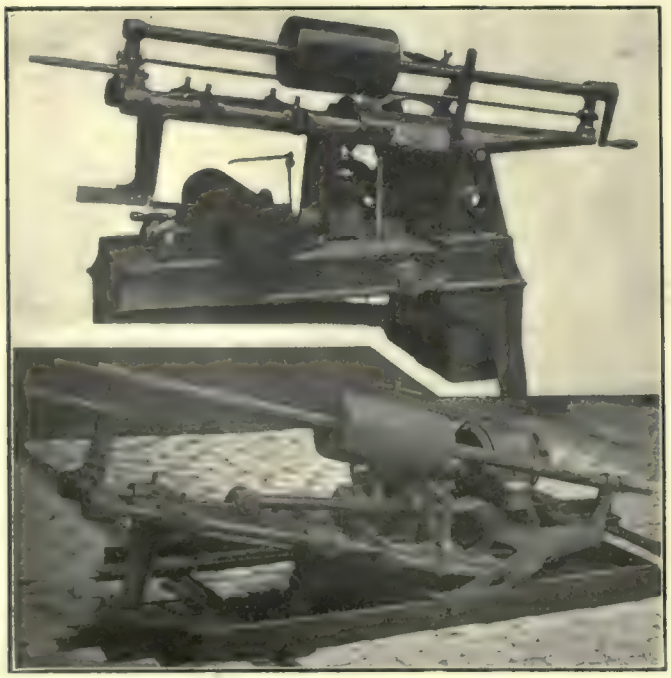
FIG. 15. 7 IN. MULTIPLE SAW FOR CUTTING BLANKS FROM ⅞ in. THICK UP TO THE CAPACITY OF THE MACHINE.

It is difficult to follow the exact action of this ram, but it will perhaps be sufficient to point out that this pump is provided with a 4-way cock with ports so arranged that when the handle is in the horizontal or working position it relieves the blades on the return stroke. When upright, it lifts the whole frame right off the work to any required height, the relief-port being provided to prevent it lifting too far. When in the third position, it holds the frame in the position it happens to be. When in the fourth, it lets the frame gently down whether the machine is standing or not. This last position is useful, as in its simple form this ram can only let the frame down when the port is uncovered, which it seldom is when the machine is standing.

The stroke in the author's machine is from 5 to 8 inches. The longer stroke adopted in the larger machines was not found necessary to get rid of the swarth, but simply because it was found advisable to reduce the strokes per minute, as the lengths of the frames increased, the momentum given by the small relief-lift becoming too much.

### Blade Length, Stroke and Diameter of Bar.

The question of the relative length of the blade to the stroke and diameter of the bar is interesting. A long stroke should be avoided, as it entails a correspondingly long saw blade as well as a more cumbrous machine. If there is no lift on the return stroke, the stroke must be as long as the section cut, in order to get rid of the swarth. Fig. 10 shows a 12-inch section being cut with a machine having only a 6-inch stroke. The middle part of the blade (shown black) has no opportunity of getting rid of its swarth, and will therefore take the greatest part of it backwards and forwards. With a sufficient lift on the return stroke, however, the swarth is dropped and raked 6 inches forward on the cutting stroke, and it is thus only necessary to make the



FIGS. 13 AND 14. SINGLE SAWING MACHINE AND SIMILAR MACHINE FOR CUTTING TRAMWAY RAILS.

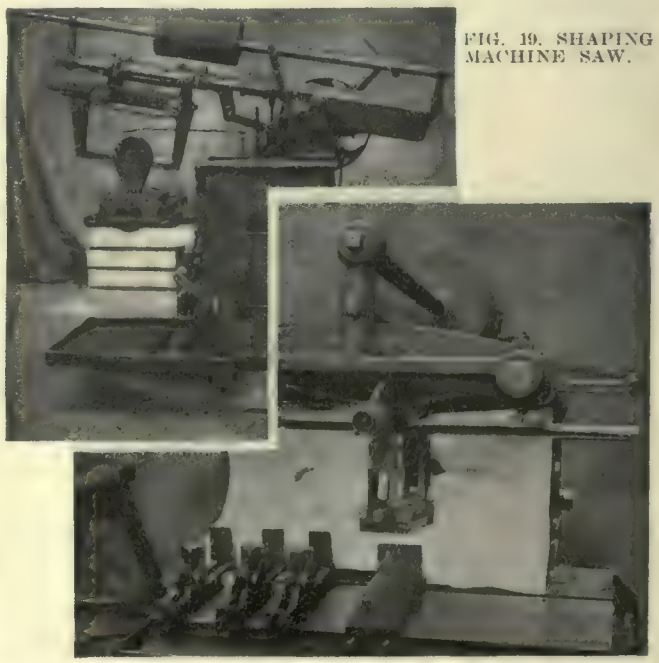


FIG. 19. SHAPING MACHINE SAW.

FIG. 17. MULTIPLE SAW RACK ARRANGEMENT FOR CUTTING BLANKS FROM 1-16 IN. TO ¾ IN. THICK.

teeth deep and large enough to hold the swarth created in two strokes.

**Saw-Blade Lubricant.**

The lubricant used for saw-blades is soap-suds, and great attention has been paid to the pump and tank connected therewith. The fact that the swarth made by the saws is exceedingly fine and that it is very much more difficult to make a pump to wear well with the suds than it is with oil, necessitates very careful provision to keep the swarth away from the pump and to make the pump as durable and as easy to repair as possible. Fig. 11 shows the arrangement of tank and connections. It will be seen that the suds are first collected by a recess in the bed, and are drained at the front end, farthest away from the swarth which is carried back by the blade working on the return stroke. The suds are next conveyed through an open trough to a tank placed at the back end of the machine. This tank is divided by two weirs (if they may be so called) into three compartments. The first weir comes to the top of the tank, leaving a space about 1 inch at the bottom for the suds to pass through into the next chamber. This is done to prevent very light swarth on the top of the suds being washed over. The suds then go over the top of the second weir into the pump chamber. In this way it is seen that the swarth has four distinct opportunities of being separated from the suds, and that it is almost impossible for any grit finally to enter the pump.

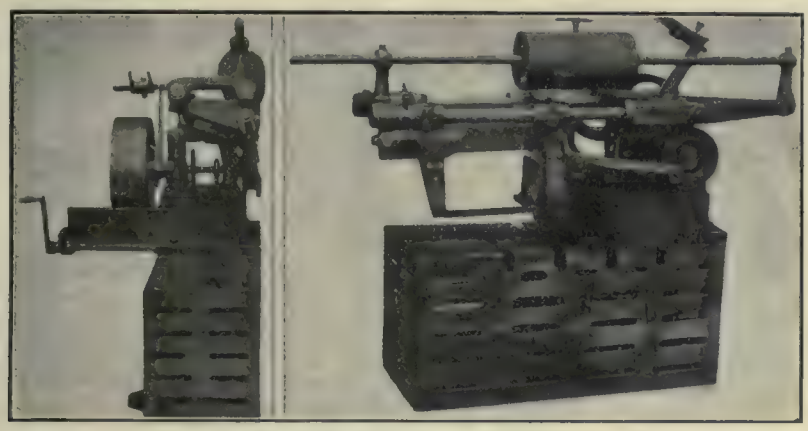


FIG. 21. SAW FOR STEEL CASTINGS.

**Pumps.**

The first thing that appeared important in connection with the pump was that it must be placed under the level of the water to avoid constant priming. Wing pumps were adopted as being the most satisfactory, but the best the author could obtain were of such a construction that they would not wear well or long with suds. The simple pump ultimately adopted is shown in Fig. 12. In this pump, a by-wash is provided, not with a separate valve, but simply by making the wings of the pump taper against the pressure, so that, when a full discharge is not required, the pressure of the suds will press these little wings back. The cover, instead of being screwed in, as is often the case, is simply fastened on with screws so that the barrel can be re-bored. Perhaps the most important feature of the design is that both wings go right through the head of the spindle and thus get an ample bearing. In these wings there are two little slots of such a length that one spring put in the middle will press up the wings on each side. The advantage of this is obvious as compared with the old method where the wings met in the middle, thus leaving but a very little bearing. The gradual wearing of this bearing caused friction and the destruction of the pump. The spindle of the author's pumps is case-hardened. The new pattern of pump has been found to be very efficient.

**Results.**

The result of all these improvements is that sawing can be done practically true, say to a hundredth of an inch in a 6-inch bar, and mild steel can be cut at a speed roughly speaking, varying from 1 inch to 2 inches square per minute. The breakage of the blade is exceedingly rare, and those of the best quality will often last several days.

**Machine Features.**

The machines are made in several forms. The Single Sawing-Machine shown in Fig. 13 is constructed for sawing pieces of large dimensions quickly and correctly. Fig. 14 shows another variety, a machine for cutting tramway rails in position. This machine rests upon two angle-irons, which in their turn rest upon the two rails. It is only necessary to disturb the pavement for the frame. The main features of the machine are standard. It makes a straight clean cut through the rails, no matter how hard, in about twenty minutes, and one blade will make from about twelve to twenty cuts before it is worn out. The Multiple Saw, Fig. 15, and Fig. 16, is specially designed to cut off blanks for dies and similar duplicate work. By a rack arrangement, Fig. 17, and Fig. 18, these blanks can be cut as thin as 1-16 inch, and with the more usual arrangement of adjustable frames, shown in Fig. 15 and Fig. 16, they can be cut from ¾ inch thick to the capacity of the machine.

What is called the Shaping Machine, Fig. 19 and Fig. 20, is another variety. This machine is provided with a table like a shaping machine on which the work is placed. By this means the work can be brought to the required position under the blades. Two blades are provided which can conveniently be be adjusted in alignment from ½ inch apart to the full capacity of the machine, usually about 5 inches. It is more particularly useful for cutting out joints of all sorts, splitting brasses, and so on.

A variation of pattern is the Runner Saw, Fig. 21. This is specially designed to cut runners off steel cast-

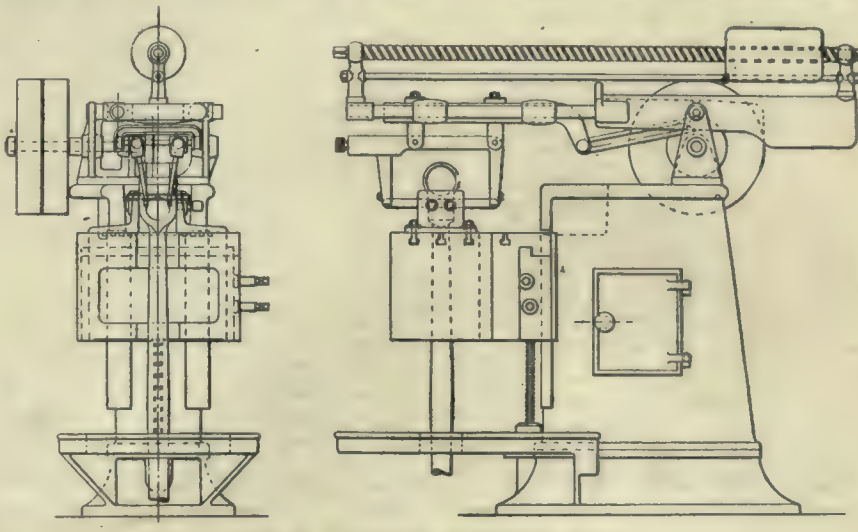


FIG. 20. SHAPING MACHINE SAW.

ings, which are bolted on the front or the side of the table. The whole head is made to traverse a foot sidewards so as to reach the runners; it can also be lifted and put forward on the bed if necessary. The saw is brought on one side of the guides so that it will cut runners quite flush to the casting where the sawholder does not foul. In the few cases where it would foul, it would cut flush within 3-16 inch. The hard blades that can be worked with this machine make this method compare favorably in many ways with the Circular or Band Sawing-Machines.

Another variety in course of construction is a machine for sawing out webs of crankshafts. Here, as in the shaping machine, there are two blades, but the table is stationary, the crankshaft being bolted down on blocks to the correct position under the blades. A horizontal blade is also provided for cutting out the bottom of the crankshaft. This third horizontal blade works independently of the two vertical ones. The frame is constructed to hold a square file as well as the saw blade. The operation is as follows:—The crankshaft must first have one hole drilled in it, say 1¼ inch or 1⅛ inch diameter. It is then bolted down on the blocks in position underneath the two vertical blades, and these blades are set to work. The file is threaded through the hole and attached to the horizontal frame and the hole filed out approximately square at the bottom. To accomplish this, the lower frame is attached to a table which can be raised and lowered by hand. There is also a hand-traverse in the horizontal direction. The table is provided with a counterweight so that the filing out of the hole can easily be manipulated by the two hand-traverses mentioned. After the hole is filed sufficiently square, an operation of a few minutes, the file is withdrawn and the blade threaded through instead. The horizontal blade is then put automatically to work. It is provided with a 4-function automatic ram, like the other, and works independently and precisely on the same system. There is usually so much less to saw horizontally than there is to saw vertically that the horizontal work will probably be finished some time before the vertical. When this is the case, the horizontal blade is removed and the frame drawn out of the way of the vertical saw before they approach near enough to foul. It will be thus seen that in the manipulation of the horizontal blade there is no time lost. A 9-inch by 9-inch crankshaft web may thus be sawn in 60 minutes to an accuracy of 1-64, using about 2 h.p. The outside of the webs can also be sawn at another operation, thus saving much valuable time afterwards on an expensive lathe.

In conclusion, the author would like to state that he has simply been trying to trace the development of a most useful tool so far as it has gone. He is not of opinion that anything like finality has yet been approached, but he believes that in rapidity of work, in the endurance of the blades, and in the size of the machines, the reciprocating straight-blade sawing machine is still in its infancy. The foregoing is a reprint of a paper read recently before the Institution of Mechanical Engineers.

## LARGE LOCOMOTIVES.

WHAT are believed to be the largest and most powerful locomotives yet constructed are now nearing completion in the shops of the American Locomotive Company. The locomotives are intended for use on the Virginian Railway and are of the Mallet compound type. Each engine will weigh in working order 540,000 lbs. (241 long tons), with 497,200 lbs. (222 long tons) on the drivers, and the combined weight of the engine and tender will be 752,000 lbs. (336 long tons). The over-all length of the engine is 65 ft. 11¼ inc., and the total length of the wheel-base is 57 ft. 4 ins. These engines will be capable of exerting a tractive effort of 115,000 lbs., or 60 per cent. more than the pioneer of this type built in America for the Baltimore and Ohio Railroad. The tractive power at slow speeds can be increased to 138,000 lbs. by working the engine simple.

The North British Locomotive Company (Limited), of Glasgow, send us the following list of large locomotives manufactured by them:—

| Engines with Tenders. | | | | Tank Engines. |
|---|---|---|---|---|
| Gauge. Ft. | In. | Engine. | Tender. | |
| 2 | 6 | 46 tons | 31 tons | 46 tons |
| 3 | 3⅜ | 58 " | 35 " | 83 " |
| 3 | 6 | 92 " | 51 " | 71 " |
| 4 | 8½ | 77 " | 56 " | 76 " |
| 5 | 3 | 80 " | 38 " | 102 " |
| 5 | 6 | 81 " | 65 " | 96 " |
| **Articulated Engines with Tenders.** | | | | **Tank.** |
| 3 | 3⅜ | 82 tons | 35 tons | — |
| 3 | 6 | 95½ " | 43½ " | — |
| 4 | 8½ | 96 " | — | 120 |

Messrs. Beyer, Peacock and Co. (Limited), of Gorton Foundry, Manchester, state that the heaviest engines they have constructed are some goods engines of the Consolidation type for a foreign railway company, which weigh in full working order 78.6 tons. The eight-wheeled tenders weigh 49.2 tons, so that the total weight of the machines is roughly 128 tons.

## TORONTO PLANT, MASSEY-HARRIS, LTD.

WHEN the new extensions and improvements now being made at the Toronto plant of Massey-Harris Co., Limited, have been completed, this foundry will be one of the most modern and up-to-date to be found, as well as one of the largest, in the Dominion. The foundry extension is 238 feet long by 95 feet in width, which will make the total length of the foundry proper 528 feet and the width 95 feet. With the new core department at one end and the cleaning department at the other, the length of the combined buildings is 913 feet—about three city blocks. This new extension to the foundry has a rather unique feature, consisting of a basement for the storage of sand and other materials, and a traveling conveyor for delivering these at any point desired.

Four large cupolas, each 96 inches diameter, and having a melting capacity of 25 tons per hour, are being installed. Under ordinary conditions, only two cupolas will be used, the other two being held in reserve or used on alternate days, thus giving ample time to prepare the cupola, and the iron and fuel for charging. The iron and fuel for the cupolas are loaded on small cars, raised to the charging floor on electric elevators, and by means of transfer tables the material can be brought to the cupola as required. The contents are deposited in the cupola by means of a pneumatic dump

## BOILER SETTINGS.

WRITING in the Electrical Review on "Boiler Settings," Mr. Edward Ingham points out that a boiler will often work satisfactorily even when the flues are cramped and restricted, so long as it is only required to work at comparatively low power. When, however, extensions of the steam plant are made, and the boiler is called upon to develop its full power, it is unable to do so. The results of this may be very serious, for it is generally a difficult matter to remedy the evil; hence the importance of building the flues of ample capacity in the first instance. In Lancashire boilers, a mistake sometimes made is to build the fire-bridges too high. Such a mistake is liable seriously to cripple the draught, and in one or two instances which have come under the writer's notice it has been impossible to maintain steam in consequence. The removal of one or two layers of brick has entirely remedied the evil. Generally speaking, a distance of not less than 10 in. should be left between the tops of the bridges and the furnace crowns at the middle.

# Lay-out and Equipment of Blacksmith's Shop--II.

By Frank Walker

*The present article is a continuation of that which appeared in our May issue, and deals more particularly with the mechanical devices which quality and quantity production in our blacksmiths' shops now demand.*

As already pointed out, there are a number of tools and appliances included in the general equipment of a blacksmith's shop which may be classed as miscellaneous or occasional, being only used as necessity requires.

Machinery and tools are as necessary to the blacksmith as they are to the machinist, enabling him to produce more and better work at a reduced cost and with greater convenience to himself. In what follows I will endeavor to describe such miscellaneous tools as I consider are indispensable for the expeditious and economic output of general blacksmith's work.

### The Power Hammer.

The most essential of these tools is undoubtedly the power hammer. In almost every class of smithwork, the necessity for a heavier blow than can be struck by hand is constantly arising. This fact has been recognized from early days as the old "Olivers" and helve hammers bear witness. There are many modern varieties of power hammers in use—steam, pneumatic, belt-driven, but, in the writer's opinion, the steam hammer is the most suitable for general all-round blacksmithing. With a good selection of dies and tools, it has, in the hands of skilled operators, almost unlimited scope; can be used as a vise or bar shears; for drop forging or bulldozing, and as a trimming press. It can not only be used for striking heavy blows and roughing out, but a great deal of work can, with care, be entirely finished under it.

In selecting and installing a steam hammer to give the greatest efficiency, careful attention should be given the following details: The actuating levers, that is, those which operate the throttle and slide valves should be so arranged that the hammer driver can stand at his work in a natural and unconstrained position, having a clear and unobstructed view of the forging on the anvil and the blacksmith operating. The throttle valve should be so fitted that it will remain in any required position without attention; that it will not jar, open or shut, with the blows of the hammer, and that the driver's whole attention may then be given to the blacksmith and his signals.

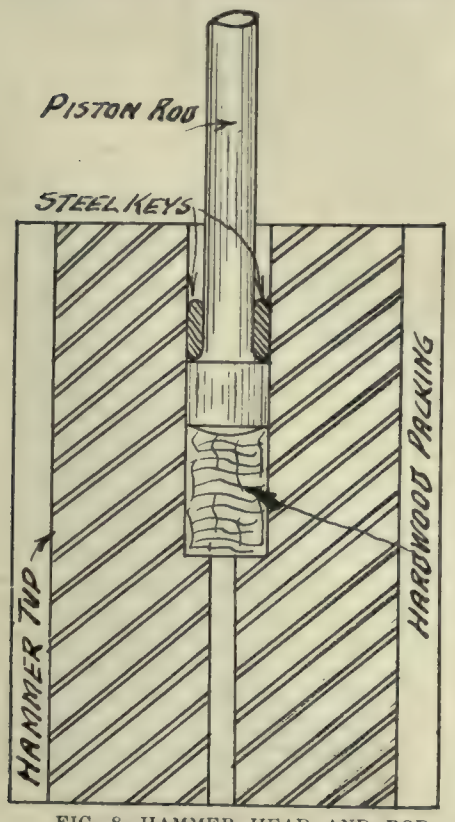



FIG. 8. HAMMER HEAD AND ROD.

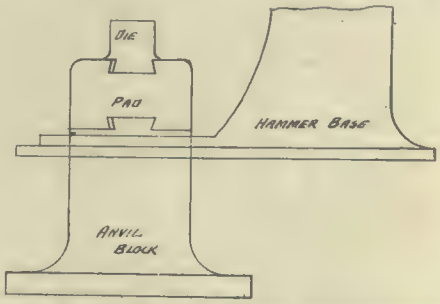



FIG. 7. ANVIL BLOCK AND BOTTOM DIE.

The method of attaching the bottom die block to the anvil block should be as shown in the sketch, Figure 7. It will be seen that a wrought iron or steel distance piece or "pad" is interposed between the anvil and the die. The top and bottom dovetails in this pad are both females, and its thickness is so proportioned that its lower joint is an inch or so above the hammer base plate. The advantages of this arrangement are:—

(1)—There is no danger of splitting the cast-iron anvil block by overtight keying, for a split anvil block means dismantling the hammer and a heavy and expensive renewal.

(2)—It admits of the die faces being easily adjusted should they work out of true. It is a well-known fact that, however strongly a hammer foundation may be built, it will always give or settle to some extent sooner or later, very often canting a little to one side. This throws the die faces out of alignment and causes the hammer to forge taper. When this occurs, it is an easy matter to remove the pad and plane it down to suit, bringing the faces again parallel. In order, however, to provide for this contingency, the anvil block should be kept up, when installing the hammer, about ½ inch higher than the bottom piston clearance calls for.

In double standard hammers, where the piston rod is keyed into the hammer block or tup, the means of attachment should be as shown in Fig. 8. This method of keying allows the rod to be securely held and cushioned without being weakened, and has been used with the greatest success in both smithy and heavy forge hammers.

The single standard or "Rigby" type of steam hammer is the most suitable for light work, but its anvil block and dies should be set at an angle of 45 degrees with the centre line in order that long work may be forged either with or across the faces without coming in contact with the frame. For drop forging and heavy work the double standard type is most suitable, as the tup of the single standard, gland guided type has a tendency to spring or wobble from side to side when it is rapidly driven; this tendency is very noticeable in old and worn hammers.

### Hammer Dies.

The top and bottom dies for general use should be made as shown in Fig. 9; the edges being square and the bottom die longer than the top. This form enables the smith to neck or break down work without using a loose or "held on" tool. The two holes shown in the bottom die will be found useful to carry stakes to prevent taper work or formers from moving side ways.

When installing the hammer, it is advisable to place, if possible, both steam and exhaust pipes below the floor level, and condensation in the steam pipe should be taken care of by an efficient drain or steam trap. If this be carefully done and the piston and valve and stem glands be kept well and tightly packed, it will obviate to a great extent the nuisance of wet hammer faces. Anyone who has worked at a steam hammer knows what an unpleasant and even dan-

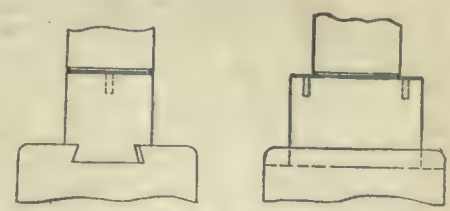


FIG. 9. SHAPE OF TOP AND BOTTOM DIES.

gerous proceeding it is to work a welding heat when the die faces are wet. The dies and loose tools used with a steam hammer are numerous and varied, their shapes and uses being limited only by the ingenuity of the operator. A good steam-hammer blacksmith will never be stuck with a job if only he is allowed the time to make efficient and sufficient tools.

**Hammer General Tools.**

In making swages and tools of that class for a hammer, it is advisable to make the impressions in the top and bottom halves of the tool each to equal one-half the diameter or thickness of the work to be finished, so that, by no mischance, can work be finished below size. When a steam hammer is installed and working it is best to appoint a man or boy as hammer driver and encourage him to take a pride in his machine and its work. Doing this will insure the hammer being well looked after and the best results obtained from it.

**Blacksmiths' Surface Plates.**

In general machine blacksmithing, men are being constantly called upon to forge odd and irregularly shaped pieces; a surface plate becomes, therefore a very necessary item in the general equipment. The blacksmith's surface plate should be strongly made, and of cast iron well re-inforced by ribs underneath. Its size should be from 5 to 6 feet long by 3 or 4 feet wide. Its face and edges should be planed and squared on one side, and one end should be scaled to inches and quarters, so that offsets and curves may be easily measured. The plate should be equipped with one or two pairs of V-blocks, a surface gauge and one or two squares of different sizes. These tools need not have the high finish of the machine shop, but should be fairly accurate. With an equipment such as this, forgings of irregular shape may be turned out within 1-32 inch of drawing office dimensions. The surface plate should be conveniently situated on the floor of the shop, supported firmly on timber blocks with its surface about 18 or 20 inches above the level of the floor.

Setting, bending or straightening should never be done on the surface plate. A substantial cast iron face block should be provided for these purposes of 4 feet or 4 feet 6 inches square with face and sides level and square but not planed; its edges and corners being rounded to different radii. A (T) slot should be planed 4 inches from one edge, in order that work may be cramped down on it for offsetting, etc. As this block is subjected to some very severe handling, it should be strongly made. The best the writer ever saw was made from a piece of 6-inch armor plate, and although its cost was excessive, it was practically unbreakable. It should be placed as close to the surface plate as convenient and supported on wooden blocks about 15 inches above floor level. Fig. 10 shows the most suitable form for this tool.

**Cone for Collars, Rings, etc.**

When making rings, collars or washers of large size, a cone such as is shown in

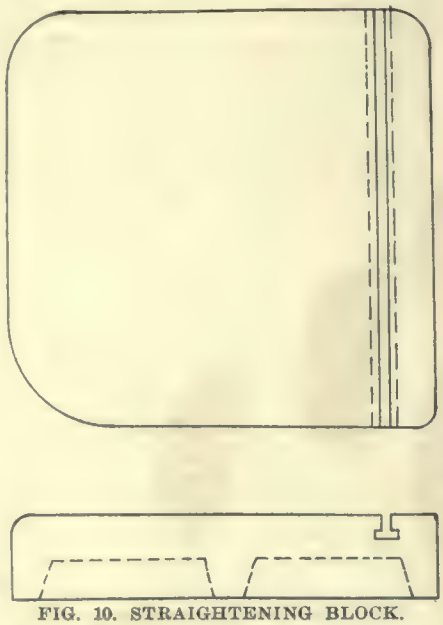


FIG. 10. STRAIGHTENING BLOCK.

Fig. 11 will be found very useful for trueing them up. Its base diameter should be 20 inches, its apex 4½ inches and its height 45 inches. It should have a (U) shaped slot running down, which gives clearance to the tong-bitts when placing or removing the work.

**Vise Equipment.**

One or two vises will be found very useful, but the benches to which they are attached should be made as small as convenient, or else they are liable to become a dumping ground for odds and ends. The best type of vise for blacksmith's work is the "Peter Wright" knee vise with 7-inch jaws, weighing about 120 pounds. It should be mounted on a wooden stand not more than 2 feet square, with the legs well splayed outwards at the feet to prevent rocking. This arrangement will be found to answer every purpose and can be moved about the shop as desired.

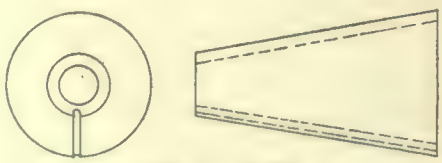


FIG. 11. CONE.

**Emery Wheel.**

An emery wheel for tool grinding must be provided. It should be of the wet grinder type and protected. A dry, unprotected emery wheel is apt to be used as a forging machine, which is bad practise for the stone and the smith. The grinder should be so situated in the shop that it is well under the foreman's eye, or else it is liable to become a gathering ground for loafers.

**Shearing Machine.**

A shearing machine that will cut round, square or flat stock up to two square inches in area will be found useful. It should be situated in close proximity to the bar rack. Stock can then be cut to suitable lengths by this means much quicker than on the anvil.

**Blast Trunk and Blower.**

Before concluding this paper I would call attention to a bad practice which obtains in some blacksmith's shops—that of placing the blast trunk and blower above the level of the forges. This is sometimes done to economize space but it is not to be recommended. During the dinner time shut down, while the fires are smouldering, gas may leak into the blast trunk through an unclosed wind gate. When the blower is again started up, this gas is forced back into the fires, and may cause an explosion that will wreck both the blast trunk and the blower. The best position for blower and blast trunk is at least 2 feet below the level of the tuyeres. This will prevent accidents by explosions, as gas being lighter than air cannot descend, unless it be forced.

## WHY DO BUSINESS MEN FAIL?

By W. C. Holman.

ACCORDING to the report of Bradstreet's, 12,646 failures occurred in the United States during 1911, and of this number 3,414 were directly attributable to incompetence. The percentage due to the various causes is tabulated as follows:—

| | |
|---|---|
| Lack of capital | 13.4 |
| Incompetence | 27.0 |
| Specific conditions | 16.9 |
| Fraud | 10.6 |
| Inexperienece | 41.1 |
| Competition | 2.9 |
| Neglect | 2.2 |
| Unwise credits | 2.0 |
| Failures of others | 1.3 |
| Extravagance | .9 |
| Speculation | .7 |

There is a world of difference between the plus salesman and the minus salesman. The plus salesman is always bringing reasons to bear why a prospect should buy, and he gets plus business; the minus salesman is busy removing reasons why his customers think they should not buy, and he gets minus business.

# British and American Machinery Exports Compared

From The London Times

*This article is written from a British standpoint and discusses frankly, backed by figures more or less reliable, the gigantic strides being made by the American manufacturer in obtaining for his product an increasingly world-wide clientele in spite of disabilities of nationality or Imperial ties.*

OF all the competitors which Great Britain has to meet, alike in the machinery markets of the British Dominions and in the neutral machinery markets of the world, the United States is by far the most formidable. A good second, at least, to Germany in scientific method and organization, at least her equal in commercial enterprise, and her superior in practical resource and invention; with a wider, more varied, and more extended experience in the application of mechanics to industrial uses, and with a superior class of technical executive labor, the United States, if not quite the best equipped country in the world for an international trade in machinery, is surpassed only by the United Kingdom.

Her chief, perhaps her only, disadvantages lie, first, in the high cost of her raw materials, notwithstanding that she can obtain all of them within her own borders; and, second, in the high cost of her labor. The former places her at a disadvantage in relation to the United Kingdom only; the latter represents a general and serious handicap. It may, however, be questioned whether these disadvantages are not more than counterbalanced by the adaptability, resource, enterprise and persistence which characterize American machinery builders.

### Importance of Machinery Exports.

It is unnecessary to dwell upon the importance of the external machinery business to this country. It is one of the great branches of industry of which it may be said that we have all the necessary materials at home, and in which we still lead the world. Our experience in this particular branch, our international connections, and our shipping facilities are superior to those of any other manufacturing nation. With the great market represented by British India we have sentimental and practical ties of enormous value possessed by no other country, while in the important markets represented by the great self-governing British Dominions we have fiscal advantages of appreciable value. It would, therefore, be remarkable and lamentable if, with these advantages, we failed to retain the premier position among the world's purveyors of machinery which we hold at present. Nevertheless, that possibility appears to be in view. The export trade in machinery of the United States has now become as important as the corresponding trade of the United Kingdom. Among the great classes of commodities which the United Kingdom sends abroad, machinery now occupies the fourth place; among those which the United States sends abroad, machinery occupies the third position.

In the figures for British exports in the year ended December 31, 1911, cotton manufactures represented a value of $514,697,625; iron and steel products, excluding machinery, $218,651,460; coal, coke and other fuel, $192,236,770; and machinery, including agricultural implements, $157,893,215. In the United States, for the fiscal year ended June 30, 1911, the exports of raw cotton were worth $609,707,150; meat and meat products, $152,193,775; machinery, including agricultural implements, $146,819,715; and iron and steel, $131,454,915.

It is unfortunate that the comparison cannot be made quite exactly, because the fiscal years of the two countries end at different periods; but in a more exact statement the relative positions of the classes would not be altered. Agricultural implements are included with machinery in the above figures, and will be in the statements which follow, for the reason that in the grouping adopted by the American authorities it does not appear quite clear where "machines" end and mere "tools" or "implements" for hand use begin. The inclusion of "implements" is, undoubtedly, to the advantage of the American figures, making them relatively larger than they would otherwise appear. Nevertheless, making full allowance for this circumstance, it is rather startling to discover that the value of the machinery which the United States sent abroad last year was not much more than $10,000,000 below that of the machinery sent overseas by the United Kingdom.

### Progress of the Two Countries.

This circumstance suggests an inquiry as to the progress of the struggle between the United Kingdom and the United States for the machinery markets of the world, and inspection of the figures for the last 15 years strongly indicates the conclusion that the supremacy so long enjoyed by Great Britain in the machinery markets of the world is being seriously threatened. In passing, it may be noted that while 1907 remains the "record" year of the United Kingdom, the maximum of the United States was reached last year, when, as already mentioned, she came within measurable distance of the United Kingdom.

From the figures given below, it will be seen that in the period of five years, 1902-06, the United States made an astonishing advance. The increase which she secured in value in that period exceeded the increase made by the United Kingdom by $45,000,000, while the ratio of that increase over the previous period of five years was more than 2½ times as great as the corresponding ratio shown by the figures of the United Kingdom. The figures for the period of five years just concluded are much more satisfactory from the British point of view, and, indeed, are distinctly encouraging. The British increase exceeds the American by nearly $30,000,000 in value; and, while the rate of increase in the United States has fallen appreciably, that shown by the British figures has nearly doubled.

**Quinquennial Growth in Machinery Exports.**

| PERIOD. | | U.S.A. | U.K. |
|---|---|---|---|
| 1897-1901 | Value .....£ | 56,014,200 | £ 93,707,847 |
| 1902-1906 | Value ..... | 83,366,328 | 112,131,170 |
| | Increase .. | 27,352,328 | 18,423,323 |
| | Per cent... | 48.83 | 19.66 |
| 1907-1911 | Value ..... | 119,108,000 | 153,596,657 |
| | Increase .. | 35,763,075 | 41,465,487 |
| | Per cent... | 42.89 | 36.98 |

This statement may be advantageously supplemented by the following, which shows the figures of the machinery exports of the two countries for the last five years:—

| | U.S.A. | U.K. |
|---|---|---|
| 1907 ..... | £ 24,141,267 | £ 32,230,127 |
| 1908 ..... | 23,734,663 | 31,430,279 |
| 1909 ..... | 19,355,932 | 28,519,271 |
| 1910 ..... | 22,512,791 | 29,848,337 |
| 1911 ..... | 29,363,347 | 31,578,643 |
| Totals ..... | £119,108,000 | £153,606,557 |
| Average ..... | 23,821,600 | 30,721,311 |

A curious parallelism runs through these detailed figures for the last five years; whenever there is a decrease in the figures of the United States there is also a decrease in those of the United Kingdom, and when there is an increase in the one there is an increase in the other. Unfortunately, while the gain in value in 1911 in the case of the United States amounts to $34,000,000, the corresponding gain in the British figures is only $8,500,000.

### Some Detailed Comparisons.

It would be interesting and useful to compare the exports of these two great trading countries class by class, but, unfortunately, this can be done only to a very limited extent. Possibly an Inter-

national Convention may some day provide a uniform classification of commodities so far as the Custom Houses of the principal trading countries are concerned, but at the moment each such authority is a law unto itself. So far as a comparison can be usefully made between the United Kingdom and the United States under existing conditions it is set out in the following statement:—

**Machinery Exports, 1911.**

| | U.S.A. | U.K. |
|---|---|---|
| Agricultural (Mowers, Reapers, Ploughs, Cultivators) | £ 5,141,488 | £ 1,566,868 |
| Other Agricultural and Implements | 2,352,942 | 617,965 |
| Agricultural Steam Engines | ..... | 1,172,981 |
| Typewriting Machines | 2,037,186 | 26,188 |
| Metal Working, including Machine Tools | 2,005,617 | 759,490 |
| Sewing Machines | 1,883,200 | 1,771,425 |
| Electrical | 1,671,796 | 1,790,719 |
| Mining | 1,461,976 | 1,034,503 |
| Locomotives, rail | 824,676 | 2,307,620 |
| Traction Engines | 755,799 | 469,774 |
| Other Prime Movers, including Gas and Oil Engines | 1,763,978 | 5,661,139 |
| Textile | ..... | 6,779,231 |
| Pumps | 741,834 | ..... |
| Cash Registers | 671,851 | ..... |
| Printing Presses and Accessories | 604,625 | ..... |
| Sugar Machinery | 539,763 | ..... |
| Wood-working | 380,825 | ..... |
| Shoe-making | 343,348 | ..... |
| Windmills | 302,081 | ..... |
| Laundry Machinery | 257,002 | ..... |
| Refrigerating and Ice-making | 128,371 | ..... |
| Adding Machines | 176,198 | ..... |
| Brewers' Machinery | 36,554 | ..... |
| All other classes | 5,282,483 | 7,620,740 |
| Totals | £29,363,347 | £31,578,643 |

It may be remarked, in passing, how much more complete and detailed are the American returns than those of the United Kingdom. The British exports of pumps, of sugar machinery, of refrigerating and ice-making plant and of printing machinery probably exceed those of the United States; and as the British authorities have the figures they might just as well be published in the usual way.

**Notable Features in U. S. Figures.**

It will be observed that the great strength of the United States lies in the agricultural classes of machinery, in typewriting machines and in machine tools, while the figures for mining machinery and traction engines also exceed those of the United Kingdom. American supremacy in these classes is undoubtedly due to the peculiar inventiveness and resourcefulness of the people, and their singular talent, which the necessities of their country have developed, for economizing labor by the application of mechanical means to the most unlikely operations of daily life, coupled with their capacity for industrial and commercial organization. Even so, the miserable position which the United Kingdom occupies in regard to typewriting machines cannot be regarded with equanimity.

Where American genius and methods are applied in the United Kingdom to an industry of an analogous character, the manufacture of sewing machines, then this country can secure as large a foreign trade, as will be seen from the above figures. The question then is inevitable—Why is there not in the United Kingdom a business in the manufacture of typewriting machines, employing British capital as well as British labor, comparable in importance with the business of manufacturing sewing machines? It is to be feared that the answer is to be found in British indifference and failure to recognize a great opportunity.

**Features in U. K. Figures.**

It is satisfactory to note British supremacy in all the heavier classes, with the exception of mining machinery, but including both electrical machinery and railway locomotives. The lead of the United Kingdom in textile machinery is overwhelming; practically no machinery of this class is exported from America, while the value of the British business is nearly $35,000,000. The immense advantage in connection with prime movers which the United Kingdom enjoys over her great competitor is another agreeable feature. Still, notwithstanding the satisfactory features revealed by these figures, the most striking and important fact which they display is that, while the exports of the United Kingdom for last year are slightly less than those of five years ago, the American figures have increased by more than $25,000,000. It is clear there can be no relaxation of effort on the part of the machinery builders of this country if they are to maintain their hold on the machinery markets of the world.

## MULTIPLE-VOLTAGE ELECTRIC TRACTION.

A PATENT recently issued to Mr. H. Ward Leonard, Bronxville, New York, is concerned with means and methods for operating electrical vehicles over long distances by the use of high-tension current, and through cities, towns, tunnels, or other desired sections at a relatively low and safe tension. A number of different locomotive arrangements are covered, employing alternating current high-tension energy and both alternating and direct current low-tension supply with provision motors for either direct or alternating current.

When direct-current motors are employed with alternating-current supply, motor generator sets are used on the locomotive. If a high tension single-phase supply is used, the current is led from the working conductors through moving contacts carried by the locomotive to two single-phase motors, each of which is directly connected to a generator. These generators, which are preferably of the low-tension direct-current type, supply the propulsion motors. The pressure in the motor circuit is regulated by varying the strength of the generator fields, which are supplied from a separate generator through reversing rheostats. When the locomotive enters a low-voltage direct-current section, a switch brings the field of one of the generators under the control of its rheostat. This is adjusted to relieve the generator of its load, and the latter is connected to the low-tension source of supply. The high-tension supply circuit is then transferred to this generator, which now operates as a motor to drive one of the single-phase motors as a generator. The power from this unit is employed to drive the other single-phase motor, and this in turn drives the other generator to which it is connected.

## SAW MILL REFUSE AS PRODUCER GAS FUEL.

THE value of sawmill refuse as a fuel in gas producers is the title of an interesting paper which was recently read before the Association of Engineering Societies in the United States, by Mr. Charles E. Snypp. In the course of the paper the author remarks:—"The refuse that we use is known as 'cypress hog.' It consists of about 50 per cent. of sawdust and 50 per cent. of chips such as are discharged from the "hog," which is a machine used by sawmills to destroy their refuse. This material runs from 30 to 55 per cent. moisture, and this moisture seems to be necessary for best working conditions. We have to guard against the sawdust blowing over into the pipes which conduct the gases to the wet scrubber. This is probably a local trouble, due, no doubt, to the strength of the blast that we use in order to get capacity. We have been able to realize full capacity using sawmill refuse, and our engines deliver a brake horse-power on about 4½ lb. of this fuel.

The changes necessary to fire sawmill refuse are merely the removing of the coal dump hoppers and substituting a hollow cylinder about 10ft. high, slightly tapered and made larger at the bottom, and fitted with a slide gate, both top and bottom. These slides are worked with levers and the sawmill refuse is locked into the producers through these tubes. To start firing a producer with sawmill refuse it is not necessary to have an underlying bed of cinders or ash to cover the blast pipe."

# Current Topics

**Acetylene Gas.** — Although acetylene gas was discovered in 1836, it was not until 1892 that its commercial development was made possible by Willson, who discovered a method of producing calcium carbide in large quantities. The application of acetylene to heating and power has been very recent indeed, and the use of acetylene and oxygen in the blow-pipe has produced almost the highest temperature known to chemistry —a temperature approximating that of the electric arc, probably above 6,000 deg. Fah. Through this means, welding has been successfully accomplished and several other important industrial applications have been found. Large steel bridge girders can thus be cut apart with ease.

**Burst Boiler Tube.**—An examination of a burst boiler tube, which was weldless, showed it to be composed of very mild steel. Hard scale, scraped off the outside of the tube near the fracture, contained a high percentage of sulphide of iron (S = 1.65 per cent.). This sulphur is considered to have been reduced from the sulphurous gases due to combustion; and as this reduction cannot take place below 750 deg. Fah., it is safely thought that the portion of the tube where the scale was found had been kept above this temperature for some time. Micro-sections were made of several parts of the tube, which proved that the metal consisted of martensite. The only method of producing martensite is by heating steel to a temperature 1,090 deg. Fah. and above and suddenly lowering it. This observation appears to point to the fact that at the time of the explosion the tube had been heated above 1,090 deg. Fah.

**Electric Railway Operation.**—In a paper read before the American Institute of Electrical Engineers dealing with economies in electric railway operation, the selection of improper gear ratios is pointed out as a source of enormous loss to the operating and manufacturing companies. Few people who have not made a study of the subject realize its importance, and there are many motors in service which are so geared as to result in a continual loss to the operating company. The large American corporations have been realizing more and more in recent years the disadvantages of high-speed gearing and some of them are now making wholesale changes in this respect, reducing the maximum speeds and making savings of 5 per cent. to 12 per cent. in power consumption, besides greatly reducing the temperature of the motors.

**Corrosion Tests of Pipes.** — Results have been recently published of cold-water corrosion tests made in 1 in. pipes 30 ft. long, the temperature range being 50-70 deg. Fah. The test lasted for nine days. Hot water tests at 125-135 deg. Fah. were also made in pipes 5 ft. long with similar fittings, the tests lasting three days. Mechanically filtered water was found to be much more corrosive than the original supply; water from a slow sand filter usually slightly more corrosive; a pond supply, showing virtually the same alkalinity, very corrosive; as was also a driven well supply. Treatment with lime decreased slightly the corrosive action, while soda had little effect. Heat, both in iron and galvanized iron pipes, greatly increased corrosive action. Alkalinity with lime increased corrosion with cold, but had a reverse action with hot water. In every case galvanized iron pipes showed less action than iron pipes, defective coating or thread cutting no doubt being to blame. Dissolved oxygen greatly assisted corrosion, the oxygen in the water being greatly diminished after the test. The removal of small amounts of protective organic matter was held responsible for the increased corrosion of filtered waters.

**Power Station Working.** — With an economizer of ample size, states Mr. J. W. Jackson in a paper on "Power Station Working," it is now possible to obtain overall boiler and economizer efficiencies of as high a figure as 85 per cent. Economizers are now so robust that they are looked upon as quite automatic and often left to themselves for more or less long periods. At the same time. close attention to economizers is well repaid in prolonging the life of the metal as well as keeping the economizer casing air-tight. By looking after air leaks in a boiler and economizer combined in regular commercial service, it is possible to reduce heat losses going up the chimney to about 10 per cent., whereas a neglect of precautions will allow these losses to rise to as much as 30 per cent. and still afford little evidence of what is going on by observation of the color, which, of course, means the temperature of the flame in the furnace. The economizer of the future, Mr. Jackson considers, is undoubtedly one built on what might be termed the "contraflo" principle, wherein the water is caused to circulate through so many sections in series. Experiments have already been carried out on these lines with beneficial results.

**Generation of Steam.**—It has recently been maintained by Mr. George Wilkinson, the chief electrical engineer of the Harrogate Electricity Works, that the generation of steam calls for a radical change in present day practice. He maintains that we have too long been content to use boiler plant, furnishing an average of from 2 lb. to 3 lb. of steam per hour per square foot of heating surface. Such practice involves the use of enormous boiler plants out of all proportion to the size of the generating plants. Reference to the plans of modern works equipped with from 10,000 to 20,000 kilowatt units of power show a separate boiler-house for each generating plant. These boiler-houses are built end-on to the power-house, and impose a heavy capital cost for boilers, buildings, flues and chimneys. They also involve heavy losses in boiler, steam pipe and flue radiation. The solution of these difficulties, Mr. Wilkinson considers, appears to lie in the introduction of gas firing, by means of flameless surface combustion on the lines first discovered by Sir Humphrey Davy, and more recently developed and set out by Professor Bone in his lectures before the Royal Institution of Great Britain in 1911. So far as investigations have gone at present, it is shown that an evaporative duty from boilers exceeding 20 lb. of steam per square foot of heating surface, can easily be obtained with a thermal efficiency corresponding to the transmission to the water in the boiler of nearly 95 per cent. of the energy represented by the net calorific value of the gas.

**Moulds.**—The moulds of the latter Bronze Age were either of clay or bronze. In casting swords and daggers of bronze the moulds must have been of clay and been heated to dull redness at the time when the metal was poured in—a method of casting which is still practised in Japan—as by no other means could such perfect castings of their thin blades have been obtained. The castings generally were hammered at the cutting edges, and it is to this hammering, and to it only, that the hardness of the cutting edges of both copper and bronze weapons is due, and not to any method of tempering. Much has been written about the so-called art of tempering bronze supposed to have been practised by the men of the Bronze Age in the manufacture of their weapons. The hardness is also said to be greater than can be given to the bronze at the present day. Mr. William Gowland has recently pointed out that this is an error, and has expressed the opinion that it can only have arisen owing to its authors never having made any comparative practical tests of the hardness of bronze.

GENERAL VIEW OF THE EXHIBITION HELD IN CONNECTION WITH THE RECENT CONVENTION OF THE ALLIED FOUNDRY ASSOCIATIONS AT BUFFALO, N.Y.

# The Foundrymen's Convention and Exhibition at Buffalo

*Among the many hundreds of delegates attending the recent Foundrymen's Convention at Buffalo, N. Y., it was universally agreed that this year's meeting was one of the most successful yet held. The quality of the papers read at the various meetings was of a high order, while their scope embraced the entire field of the metal founding industries. The exhibition of foundry equipment held in connection with the Convention was also a most successful affair from every point of view.*

THE seventeenth annual convention of the American Foundrymen's and Allied Associations was held in Buffalo from Sept. 23 to Sept. 27 inclusive, and was undoubtedly one that will tend to strengthen the various bodies to a marked extent.

Each association had its headquarters at a different hotel and there the business meetings and readings and discussions of the numerous papers took place. The American Foundrymen's Association were located at the Hotel Statler, the American Institute of Metals at the Iroquois, while the Associated Foundry Foremen gathered at the Hotel Broezel.

**Exhibition Features.**

The Foundry and Machine Exhibition Co. held their exhibit in the Broadway Arsenal, a spacious building excellently suited to the purpose. Here were to be seen the leading products of over one hundred manufacturers of foundrymen's requirements, forming perhaps an even more comprehensive collection than that at Pittsburg last year. Among the numerous molding machines exhibited many showed improvements in design over those of last year; though on the whole really novel features were not very noticeable. The prominence given to sandblasting outfits was especially noteworthy, and this method of cleaning castings seems to be coming into well-nigh universal use. Some of the self-contained machines for sand-blasting small castings were very complete and appeared to be quite dustless in operation. Jolt ramming machines were shown with capacities ranging from 100 lbs. to 80,000 lbs., many of them being shown in operation, as were the majority of the molding machines. Exhibits of facings, partings, core binders and similar lines were numerous, in fact every branch of foundry equipment was well represented.

The exhibition was open each day from 9 A.M. to 10 P.M., and attracted large crowds, wro evinced great interest in the fine display.

**Convention Sessions Opened.**

The executive sessions of the three organizations of the allied foundry associations were launched on Tuesday morning, Sept. 24th, when the American Foundrymen's Association, the American Institute of Metals, and the Associated Foundry Foremen met together at the Hotel Statler under the presidency of Major Joseph T. Speer, President A. F. A. The delegates were welcomed by Mayor Fuhrman, of Buffalo, who was followed by Orson E. Yeager, president of the Buffalo Chamber of Commerce. A cordial reply on behalf of the three associations was made by A. E. Howell, Nashville, Tenn., who is one of the vice-presidents of the A. F. A. An adjournment shortly afterwards took place to make way for the regular meeting of the American Foundrymen's Association.

Major Speer gave a brief presidential address, in the course of which he recommended that the constitution be made more elastic with a view to rendering co-operation between the various associations of more effect. This suggestion was followed by a motion, which was carried, that a committee be appointed to revise the by-laws.

**Secretaries' Reports.**

Dr. Richard Moldenke, secretary-treasurer of the American Foundrymen's Association presented an interesting annual report. He said that the association had suffered considerably from the recent depression in the foundry industry, fully 15 per cent. of the members having either resigned or having had to be dropped from the roll. A vigorous campaign for new members had, however, served to recover some of the lost ground with the result that the present membership amounted to 626, with fresh names coming in daily. This showed, better than anything else, the resumption of business activity and business optimism. After some further remarks on the same subject Dr. Moldenke went on to say that a great interest was now being taken in the A. F. A. by the men in the malleable casting and steel casting trades, which augured well for those industries, as a frank discussion of methods of manufacture eliminated waste and educated the consumer up to what can and what cannot be done in the foundry. The financial portion of the report was very satisfactory, the total income for the year ending July 1, 1912, having been $5,162.09, and the total expenditure $4,793.53; leaving a balance in the treasury of $368.56.

The report of W. M. Corse, secretary-treasurer of the American Institute of Metals, showed this body to be in a very flourishing condition. The membership had steadily increased until it now stood at a total of 310. Mr. Corse was followed by A. D. Little, official chemist to the Institute, who presented his first annual report. This dealt with the progress and developments that have taken place during the past year in the non-ferrous casting industry. Mr. Little dealt with the subject in an extremely interesting and attractive manner.

**Excellent Papers Read.**

At the morning and afternoon sessions of the A. F. A. and the A. I. M. a large number of high class papers were read and gave rise to some interesting discussions. A partial list of these papers was given in the September issue of Canadian Foundryman, and the more important of them will be published in our columns in due course.

**Entertainments, Etc.**

The local entertainment committee, under the chairmanship of Frank B. Baird, arranged an attractive programme for the delegates, special provision being made for the large number of lady visitors who attended the convention. The latter on Tuesday morning were conveyed by special train to East Aurora, where the Roycroft shops were visited. In the evening the Foundry Foremen held their banquet, while their ladies visited Shea's theatre. On Wednesday afternoon there was a steamboat excursion in Buffalo harbor, down the Niagara River and around Grand Island, free to all registered delegates, both ladies and gentlemen. On Thursday morning the ladies were taken for an automobile tour of the city, afterwards visiting the Larkin Company's plant, where luncheon was served. On Thursday evening there was a well attended subscription banquet at the Hotel Statler, and a theatre party at Shea's for ladies registered at the headquarters of the A. F. A. and A. I. M.

**Foundries Inspected.**

The following plants threw open their doors to the visiting delegates, large numbers of whom took advantage of the courtesy thus extended them:—Acme Steel & Malleable Iron Works; Aluminum Castings Co.; Buffalo Pitts Co.; Bingham & Taylor; Buffalo Foundry & Machine Co.; Frontier Iron Works; Jewell Steel & Malleable Iron Co.; Strong Steel Foundry; Atlas Steel Foundry; H. G. Trant; Ginther's Sons Co.; Lumen Bearing Co.; Pratt & Letchworth; Buffalo Forge Co.; Farrar & Trefts (East Buffalo Iron Works).

**Canadian Delegates.**

Among the large numbers of Canadians present we noticed the following:—E. A. Morrison, Canada Foundry, Toronto; T. J. Best and J. A. Robinson, War-

den King Ltd., Montreal; H. Goodes, John Inglis Co., Toronto; W. R. Gilmore, W. Shand, G. W. Duggan, R. Broad and W. Cox, Canadian Steel Foundries, Welland; J. F. Gaffney, Drummond, McCall Co., Montreal; Chas. J. Caley, Canadian Yale & Towne, Ltd., St. Catharines; T. R. Lagan and W. Hackadon, Waterous Engine Works, Brantford; F. J. Ross, Dominion Foundry Supply Co., Toronto; J. Howard and J. A. McLaren, The Galt Brass Co., Galt; H. O. Kerr, Kerr Engine Co., Walkerville; A. G. Storie, Ontario Malleable Iron Co., Oshawa; Percy C. Brooks, A. Dawson and J. H. Anisborough, Canadian Fairbanks-Morse Co., Toronto; G. J. Reichert, Pratt & Letchworth Co., Brantford; Rupert G. Bruce, Canadian Hanson & Van Winkle Co., Toronto; H. V. Tyrrell, J. H. Williams and F. T. Young, "The Canadian Foundryman," Toronto; L. L. Anthes, Anthes Foundry, Toronto; W. H. Davis and W. A. Jackson, Steel & Radiation, Ltd., Toronto; F. Wedlake and A. E. Williams, Cockshutt Plow Co., Brantford; J. R. Phillips, Pease Foundry Co., Toronto; S. B. Chadsey and C. H. Grobb, Massey-Harris Co., Toronto; Arthur Smith, Canadian Ingersoll-Rand Co., Sherbrooke; J. H. Fryer, H. Erbe and R. Sullivan, Galt Malleable Iron Co., Galt; A. J. Palmer and J. Barter, Empire Mfg Co., London, Ont.; T. L. Moffat, Moffat Stove Co., Weston; Geo. Baird and Sherwood Lake, Waterous Engine Works, Brantford; W. J. Verity, Verity Plow Co., Brantford; J. Kelley and T. Hopkins, Guelph Stove Co., Guelph; A. G. McIntyre and F. Campbell, Foundry Specialties, Ltd., Toronto; F. E. Lauer, Foss & Hill Machinery Company, Montreal; D. M. Galloway and A. McAllister, Canadian Northern Railway, Winnipeg; H. E. Oulette, F. Hyde & Co., Montreal; H. G. Walker, Specialty Manufacturing Co., Grimsby, Ont.; A. D. Mathieson and J. Linklater, International Harvester Co., Hamilton; J. H. Eastham, The John McDougall Caledonia Iron Works, Montreal; C. M. Rudel, Rudel-Belknap Machinery Co., Montreal; H. S. Carter, R. J. Mercur & Co., Toronto; W. J. Thompson and W. T. Cole, Hamilton Facing Mills, Hamilton; A. E. Pipher, Standard Ideal Co., Port Hope; Colin Osborne, Autocall Co., Hamilton; W. D. Varey and C. Biehl, Western Foundry, Wingham; P. McMichael and S. H. Todd, Dominion Radiator Co., Toronto; M. J. Allen and A. Chase, Sawyer-Massey Co., Hamilton; J. W. Jamieson and F. R. Elbert, Bowes, Jamieson Co., Hamilton; P. Whitfield and F. W. Head, John Deere Agricultural Works, Welland; H. V. Hamilton, Steel Company of Canada, Hamilton; C. E. Rahder, Bowmanville Foundry Co., Bowmanville; G. A. Watson, Meaford Wheelbarrow Co., Meaford; T. H. Gilvear, Berlin Machine Works, Hamilton; T. L. Taylor and J. M. Moore, The McLary Mfg. Co., London, Ont.; W. Wilson, Galt Foundary Co., Galt; H. E. Mallett and E. Austin, McKinnon Dash Co., St. Catharines; H. F. White, The Geo. White & Sons Co., London, Ont.; A. J. Oliver, The R. McDougall Co., Galt; R. Rutledge, Gould, Shapley & Muir, Brantford; F. S. Ferguson and T. P. Charlton, Canada Iron Corporation, Montreal; E. B. Fleury, Hamilton.

### Next Year's Convention.

At the final session of the American Foundrymen's Association on the afternoon of Thursday, Sept. 26, it was announced that invitations for the 1913 Convention had been received from Milwaukee and Chicago, while San Francisco was desirous of securing the honor in 1915—that being the year of the proposed Panama-Pacific Exposition. The choice of a city for the 1913 Convention will be made by the executive at a later date and announced in due course.

### A. F. A. Officers.

The officers of the American Foundrymen's Association for the ensuing year were elected as follows:—President, H. D. Miles, Buffalo, N.Y.; Secretary-treasurer, Dr. Richard Moldenke, Watchung, N. J.; Vice-Presidents, F. B. Farnsworth, New Haven, Conn.; T. L. Richmond, Buffalo, N. Y.; Walter Wood, Philadelphia, Pa.; A. E. Howell, Nashville, Tenn.; R. A. Bull, Granite City, Ill.; T. W. Sheriff, Milwaukee, Wis.; D. R. Lombard, Augusta, Ga.; and S. B. Chadsey, Toronto, Ont.

In recognition of his valuable services to the Association during his two terms of office, the retiring president, Major J. T. Speer, was unanimously elected an honorary life member of the A. F. A.

### A. I. M. Officers.

At the closing session of the American Institute of Metals the following officers were elected:—President, L. W. Olson, Mansfield, Ohio; Secretary-Treasurer, W. M. Corse, Buffalo, N. Y. Vice-Presidents: Rolling Mills, W. H. Bassett, Ass't Supt. American Brass Co., Waterbury, Conn.; New England district, W. L. Belknap, President Belknap Mfg. Co., Bridgeport, Conn.; Pennsylvania district, Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.; New York and New Jersey district, F. Reidenbach, Genesee Metal Co., Rochester, N. Y.; Chicago District, Philip Mueller, Supt. H. Mueller Mfg. Co., Decatur, Ill.; Michigan-Ohio district, F. O. Clements, National Cash Register Co., Dayton, Ohio; City of Chicago, Wisconsin, etc., C. E. Hoyt, Lewis Institute, Chicago; Virginia & South, G. H. Clamer, Ajax Metal Co., Philadelphia, Pa.; Ontario and Western Canada, C. M. Ivey, Empire Mfg. Co., Ltd., London, Ont.; Quebec and Maritime Provinces, Robert Job, Vice-Pres. The Milton Hersey Co., Ltd., Montreal, Que.

### A. F. F. Officers.

The Associated Foundry Foremen held the election of officers at their morning session on Thursday, Sept. 26, when the following were appointed:—President, Robert Walker, Port Chester, N. Y.; Vice-President, P. M. Wooden, Columbus, Ind.; Secretary-Treasurer, Robert B. Thompson, Buffalo, N. Y. Mr. Thompson is the retiring president.

### Foundry and Machine Exhibition Company.

The annual meeting of this company is held on the last Monday in October, when the election of officers will take place. The present officials are:

President, H. R. Atwater, the Osborn Mfg. Co., Cleveland, Ohio.

Vice-President, R. S. Buch, A. Buch's Son's Co., Elizabethtown, Pa.

Treasurer, J. S. McCormick, J. S. McCormick Co., Pittsburg, Pa.

Secretary, C. E. Hoyt, Lewis Institute, Chicago, Ill.

Directors: Wilfred Lewis, the Tabor Mfg. Co., Philadelphia, Pa.; H. R. Atwater, the Osborne Mfg. Co., Cleveland, Ohio; F. N. Perkins, Arcade Mfg. Co., Freeport, Ill.; E. H. Mumford, Mumford Moulding Machine Co., New York City, N. Y.; A. M. Frauenheim, Herman Pneumatic Machine Co., Zelienpole, Pa.; R. S. Buch, A. Buch's Sons Co., Elizabethtown, Pa.; Edward A. Pridmore, International Moulding Machine Co., Chicago, Ill.; J. W. Campbell, the Cleveland Wire Spring Co., Cleveland, Ohio; and Henry A. Pridmore, of Henry E. Pridmore, Chicago, Ill.

## OIL AS A SUBSTITUTE FOR COAL.

THE recent coal strikes in Germany have had the result of intensifying public interest in that country on the question of substitutes for coal. In many industrial works requiring a large amount of coal, says the British Consul-General for Westphalia and the Rhenish Provinces, steam engines have of late years been partly replaced by engines worked with benzol and oils of various kinds. As coals become more expensive, technical improvements in oil engines are being made, which will in time cause the use of coal to decrease. Oils of all kinds, particularly petroleum, says the consul-general, suggest themselves as substitutes for coal. Of late, the Diesel engine has attracted a great amount of attention, and in connection therewith, the improvements in the process of obtaining oils from coal. It is only quite recently that the difficulties experienced with these oils have been overcome. Since the last coal strike, many firms have turned to oil in order to lessen the danger of running short of coal, and many firms have made slight alterations in portions of their furnaces in order to be able to burn oil fuel.

## A FOREMAN'S JUDGMENT.

THIS is one aspect of a foreman's character which counts for much in the conduct of a machine tool shop. Judgment he must possess in addition to knowing his work and how to manage men. A well-balanced and ready judgment is an invaluable possession. It begets confidence in him; men are willing to be guided by him, and defer to his decisions, believing that they are on the whole sound and good. Rapidity of decision does not always go hand in hand with good judgment. A man may decide a point quickly because he is hurried and worried and has many other things to consider. Then he may wish he had decided on some other course, and perhaps reverse his previous decision. That is a mistake on the part of a leader. The hesitating man never commands confidence. Confidence in one's own judgment begets confidence in those around. It is much better when a man feels doubtful of a certain course to defer decision if possible till the next day, and bring waking thoughts to bear upon it.

### Production Economy.

Among the problems that call for good judgment are, first, those relating to the economies of production. Naturally a man of sound judgment will consider the total economies of a job throughout every process to which it is subject, and bring his brain to bear on the problem of how to carry it out with the best saving on the whole to the firm.

Another matter is the giving out of work. Some man can be trusted better with certain jobs than with others. It is not difficult to settle the choice in the case of old hands, but it becomes so when a fluctuating body of men put on during busy times have to be handled. A good method often in such cases is to put the new men to work along with the old tried hands, who will then become a valuable check on the new men.

### Errors In Castings.

A further point may be mentioned here. Errors in castings may not be discovered before the work leaves the pattern shop or the foundry, and are only found out after the castings have got into the machine shop or the turnery. If time presses, a settlement as to the best course to adopt must be arrived at readily. In the pattern shop the foreman would have the matter practically in his own hands, and could have a blunder rectified without much attention being called to it. In the foundry it would probably only mean cutting about the mold, stopping off, or making good with new pattern parts. The bugbear then is, that box bars and lifters often come in the way, and a mould must be broken up, the pattern altered, and the mould made again entirely. In the machine shop, however, the blunder becomes glaring, and is more annoying to the foreman than if it had been detected earlier, and he is expected to be ready of resource in settling how best to get over it with the minimum of loss and delay.

### Choice of Machines.

One of the most important sections of the duties of a machine shop foreman is to decide on what machines certain work shall be done. One not infrequently sees jobs put upon machines which could have been done either more economically or more accurately upon others. It may often happen that milling will be preferable to planing or shaping; but it will also sometimes be the case that the latter methods are more economical, and perhaps more accurate. The planing machine is eminently adapted for tooling work in quantity, that is, a long row of similar objects can be bolted to the table of a planing machine much more expeditiously than they could be done singly on a vertical milling machine or on a shaper; still, having a horizontal milling machine, that would often be better than the planer.

### Undue Handling of Material.

An important element in economical workshop practice is to avoid undue handling of work. Neither material nor work in progress should be moved or adjusted twice if once will do. Always, if possible, material should be dumped down in the spot where it is to remain. It is a great waste of time to put work down temporarily and then have to move it again. A piece of work should never be set twice on a machine if it can be tooled at one setting. Work should not be shifted from one machine to another if all the tooling can be done economically on one. Re-setting occupies time, and is a cause of inaccuracy. The greater the number of tools, therefore, that can be brought to bear on a job at once, the better. There are, of course, practical limits to the application of this principle. It would in many cases cost more to rig up a machine for performing two or three simultaneous operations than it would to re-set the work. In standard production, however, manufacturers find that it pays to construct special machines solely for the purpose of performing many similar operations at the same time. If balanced with good judgment, the rule should be observed to avoid re-setting as far as practicable and economical.

Thus in the management of both men and of work, the foreman must be ever alert in the exercise of a sound and ripened judgment. These things cannot be taught; they must be acquired in the ever changing conditions which exist in the practice of hundreds of shops. No single shop can give its laws to another, because machine equipments, character and volume of work done, and the class of hands available, are all vital factors. The best foreman is not, therefore, necessarily the best handicraftsman, but the man whose judgment is the most clear and well balanced.—Practical Engineer Supplement.

## HORSE-POWER RATING OF MOTOR CARS.

THE report of the Committee in England on the horse-power rating of motor-cars was issued a few days ago by the Treasury. The Committee summarised their recommendations in the form of amended regulations which they think might take the place of the provisional regulations now in force. Some of their draft regulations are the following:—

For the purposes of these, the horse-power of any motor-car deriving its motive power wholly from an internal combustion engine worked by a cylinder or cylinders shall be taken to be:—

(a)—In the case of a single-cylinder engine the horse-power attributable to the cylinder of the engine.

(b)—In the case of an engine having two or more cylinders, the sum of the horse-powers attributable to the separate cylinders.

The horse-power attributable to any cylinder of an internal combustion engine shall be deemed to be equal to the square of the internal diameter of such cylinder measured in inches divided by a numeral:

(a)—In the case of a single acting cylinder having a single piston, the numeral used as divisor shall be 2.5.

(b)—In the case of a single-acting cylinder having two pistons, the numeral used as a divisor shall be 1.6.

The horse-power of any motor-car deriving its power wholly from a steam-engine shall be taken to be proportionate to the effective heating surface of the boiler supplying steam to such engine, at the rate of 1 h.p. for every 3 sq. ft. of such effective heating surface, and the effective heating surface shall be taken to be:

(a)—In the case of a boiler having horizontal or approximately horizontal tubes, the whole of that surface of the tubes which is exposed to the flame or hot gases.

(b)—In the case of a boiler having vertical or approximately vertical tubes, half of that surface of the tubes which is exposed to the flame or hot gases.

Any motor-car deriving its motive power from an electric motor or motors shall be deemed to be of a horse-power exceeding 6½, but not exceeding 12.

## TEXTILE MILL DRIVING.

A HIGHLY practical arrangement was made by the Textile Institute for its recent congress. Four authors had been invited to discuss the driving of textile mills from the respective points of view of the steam engine, the Diesel engine, the gas engine, and the electric motor. To enable comparable figures to appear in the papers, the authors had met and agreed upon certain bases of comparison, and the result was a series of entertaining papers.

Mr. J. F. Crowley presented a very good case for electricity. He said that over 7,000 motors had been sold in England for loom driving. The case for electrical driving did not depend merely on a saving in transmission loss. Steadiness of drive and the advantages accruing from the adoption of individual drive were important factors. Then there were flexibility, lighter and cheaper buildings, less floor space, improved lighting, and so forth. It was difficult to convince mill owners that serious fluctuations in speed occur in ordinary mechanical drives. Mr. Woodhouse had made tests on a mule counter-shaft, the mule being the worst offender in the textile mill, which showed that with mechanical drive the maximum speed range was 25 per cent. of the mean speed in the case of mechanical drive. This was reduced to 17 per cent. for an individual D. C. electric motor, and to 6 per cent. for an A. C. motor. The mule in a mechanically operated mill affected the running of every machine connected with the shafting from which the mules were operated. With electrical driving this trouble disappeared.

### Constant Speed Desirable.

It was important to remember that constant speed should be maintained during the actual spinning portion of the mule cycle, and that a given variation in speed would be more serious with a grouped drive than for an individual drive, since, in the former case, the speed fluctuations would result from the variation in load of the mule itself, and would, therefore, follow the cycle of operations in the mule. Individually driven mules gave a 5 per cent. increased production over group or mechanically driven machines. For the driving of ring-spinning machines, electricity has peculiar advantages. In the worsted trade, ring v. mule spinning was a matter of argument, but the ring frame had been aided by individual electric drive with automatic speed control, and as much as 18 per cent. in time had been saved by this method against electrical driving alone. A ring doubling frame tested on the Lancashire Electric Power Co.'s mains showed a maximum speed range of 6 per cent. of its mean speed when mechanically driven, and of 0.5 per cent. when electrically driven. By adopting electric driving, loom speeds could be increased. Speed fluctuations grew worse as the distance from the engine increased, and in a Yorkshire mill a 3 per cent. variation in engine speed was magnified to one of 20 per cent. on the line shafting.

### Test Data.

Tests taken some time ago to convince a doubting manufacturer of the advantages of electrical driving showed that the loom speeds could be raised 9 per cent. without any increase in breakage, the material improved in quality, and the production increased from 15 to 20 per cent. Increased production was of much importance. From Board of Trade returns he could show that a 10 per cent. increase in production in one case resulted in a 30 per cent. increase in profits. Motors for textile work had to be specially designed. They must be well protected from dust and "fly." Their rating must be liberal, as the load is usually continuous. Their efficiency must be high over a wide range of load. Since the starting torque for loom motors was two and a half times normal and for spinning motors twice normal, the starting torque must be high. Their speed regulation from no load to full load must be small as well as over the usual variations in voltage.

## ROPE TRANSMISSION.

IN a paper on "The Transmission of Power by Ropes," read by Mr. Edwin Kenyon before the Canadian Society of Civil Engineers, it was stated that, all things being equal, the durability of cotton ropes may be gauged by sectional area, and the most economical diameters range from 1½ in. to 1¾ in. A remarkable case of longevity has occurred in the case of twenty-four cotton ropes 1¾ in. diameter, employed to transmit 820 horse-power direct from an engine fly-wheel 28 ft. diameter in a Lancashire cotton mill. They were fixed in September, 1878, and have been running from then till now, a period of over thirty three years. The lives of other cotton ropes under similar conditions have extended over periods little short of this, while others fixed from eleven to fifteen years ago and working without cessation, week-ends excepted, are still doing good service. Such longevity leads to the conclusion that "fatigue" due to constant activity does not readily manifest itself in well-made cotton driving ropes. Their quick recovery from driving strain is suggested as the cause, seeing that they pull down on the working side but bulge out to their normal diameter immediately they pass to the trailing or slack side of the pulleys.

## CANADIAN TRADE.

CORRECTED customs for the year ending March 31, 1912, show that the aggregate foreign trade of Canada was $847,637,794, made up of exports of $315,317,250, and imports of $559,320,544. The total duty collected was $87,576,036, as compared with $73,312,367 in 1910.

### Exports.

The United Kingdom was the best customer of Canada, taking $151,853,413 of her exports. The United States took $120,534,634. Other countries to which Canadian goods were exported were:—West Indies, $6,900,940; South America, $4,825,030; Newfoundland, $4,284,313; Anustralia, $3,947,015; Germany, $3,814,914; Belgium, $3,732,222; France, $2,123,705.

### Imports.

Canada bought most heavily from the United States, her imports from that country being $356,354,487; those from Great Britain were $116,907,022, while those from other countries were:—France, $11,744,664; Germany, $11,090,005; South America, $10,533,310; West Indies, $8,490,878; Switzerland, $3,458,006; Belgium, $3,686,419; China and Japan, $3,112,982. Of the duty collected $49,177,584 came from the United States and $22,367,069 from Great Britain. The percentage of duty on all goods imported for cinsumption was 16.

### Provincial Record.

The trade was divided among the provinces as follows:—

| Province. | Exports. | Imports. |
|---|---|---|
| Ontario | $108,554,833 | $240,262,151 |
| Quebec | 123,104,836 | 164,349,054 |
| Nova Scotia | 23,569,432 | 19,285,187 |
| New Brunswick | 28,979,547 | 11,953,742 |
| Manitoba | 3,302,815 | 44,223,896 |
| British Columbia | 20,272,840 | 49,345,161 |
| P.E Island | 583,211 | 703,269 |
| Alberta | 52,685 | 13,878,838 |
| Saskatchewan | 4,621,809 | 14,266,969 |
| Yukon Territory | 2,275,241 | 952,669 |

### Customs Revenue.

The Customs revenue was derived from the several provinces as follows:—

| | |
|---|---|
| Ontario | $34,326,700 |
| Quebec | 23,047,221 |
| New Brunswick | 1,842,036 |
| Nova Scotia | 3,074,663 |
| Manitoba | 8,781,843 |
| British Columbia | 10,612,828 |
| Prince Edward Island | 130,604 |
| Alberta | 3,137,456 |
| Saskatchewan | 2,452,052 |
| Yukon Territory | 163,338 |

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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Vol. VIII. OCTOBER, 1912 No. 10


## A PHASE OF TECHNICAL EDUCATION.

ATTENTION has already been drawn in the editorial columns of this journal to the widespread desire towards, and inauguration of schools or institutes for the dissemination of technical education in leading cities of the Dominion of Canada, and at this particular juncture, we desire to discuss a feature of the situation which, without mincing matters, shows the utter disregard being shown in one or more instances, at least, to the most elementary considerations which nature demands should be fulfilled between a man and his fellowman. We refer to the disposition or attempt to give something for nothing.

Let us say at the outset, that we recognize not only the value, but the need of technical education in this land of possibilities, but in so doing, and with all due respect to the sincerity of purpose, if it exist, of the active agents in the movement, that we are heartily out of sympathy with a system which provides fat salaries, secured by Government subsidy or otherwise, to men who will lend themselves to such a proposition as the levying of nominal fees, baited with the catch-penny return of same on a mere attendance basis. We say without hesitation, and backed by experience, that anything worth having is, in the nature of things, worth paying for, and that a technical education, like everything else, cannot be secured for a trifling two hundred cents or thereby. Much money has been spent in securing data, much is being and will be spent in providing comfortable cribs for administrators, palatial buildings and elaborate equipment, but little thought and still less consideration is being given to the ultimate object or outcome of the scheme. Little if any allowance has been made for the student feature, its disabilities and moral sensibility—the ridiculous, insulting-to-moral-sensibility and "drink, puppy, drink," scale of fees being altogether ample evidence.

The acquirement of a sound technical education is a rational purchase, and should in the first instance be reckoned as such by the sellers. There should be none of the "cheap jewelry" feature, and still less of the "get-rich-quick" methods connected with its get-up. Students of the mechanical arts have just as keen a perception, and are as capable of analyzing "wildcat" schemes of acquiring knowledge as are the most discriminating in other spheres, where men barter for at least one hundred cents to the dollar. Speculation in most cases is disastrous, but even in "mines" has panned out on occasion, satisfactorily. Has speculation, we ask, and we know it has been tried, ever succeeded in the realm of education? With all respect to the enthusiasm of well paid dispensers of knowledge, let us say, and that something more convincing is required to impress both the student and the onlooker, that the sacrifice of the former's time, disregarding the required financial outlay, is worth while. There is an increasingly strong desire abroad to-day to furnish a high class product in every line of manufacture, and much thought and study has been and is being given to its realization in the mechanical arts. Operators have become imbued with the spirit of the movement, and recognize in it the certainty of higher returns to themselves, corresponding to the improved methods of production. The natural line of reasoning they will take in this technical education feature of which we have been speaking, is that little, if anything, is likely to be gained. A youth or man, to-day, finds study hard and irksome, perhaps more so than in any previous epoch, and a stake of two dollars per session will not tend to relieve the difficulties, neither will it make him mourn much, should the burden of acquirement of knowledge prove too heavy to bear.

It has been urged that the "low fee and return" method admits of the opportunity being available to lads earning small salaries, who have aspirations to higher achievement, and whose very youthfulness precludes the possibility of paying more, or indeed, anything, for a considerable time in the immediate future. In such cases, while there may be some semblance of justification, it is overwhelmingly apparent that the tendency will be towards removal of much of the ambition and incentive to overcome such disabilities as that of the cost of educating one's self. Nominal fees, such as are being charged, lead to monster enrollments at session opening. Unfortunately, however, these have never been of even statistical value, much less creditable for a reasonable percentage of individual achievement.

All experience in technical education work goes to show that enrollment by hundreds in all or any subject means at a period long before vacation is reached, reduction to a mere handful. Further, technical schools, no matter how magnificently equippde, and efficiently staffed make no pretence of catering to the abnormal rush to become members of the more familiar mechanical classes. Were they to do so, there is a probability that more "wheat" would be garnered, but it is doubtful if the means would justify the end. Large classes minimize the chances of individual instruction, and most students need the latter to the fullest extent possible. If they don't get it they naturally quit, and more or less discontent, accompanied by unkind but deserved criticism, follows. Instances are on record where, in spite of reasonably high fees, it became necessary, on account of the huge enrollment taxing the college capacity, to double-up the fees, and whether it was complimentary to the value of the instruction being given, or for some other reason, the enrollment suffered little in consequence.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

## DUPLEX SAFETY TRIPPING DEVICE.

By J. H. R.

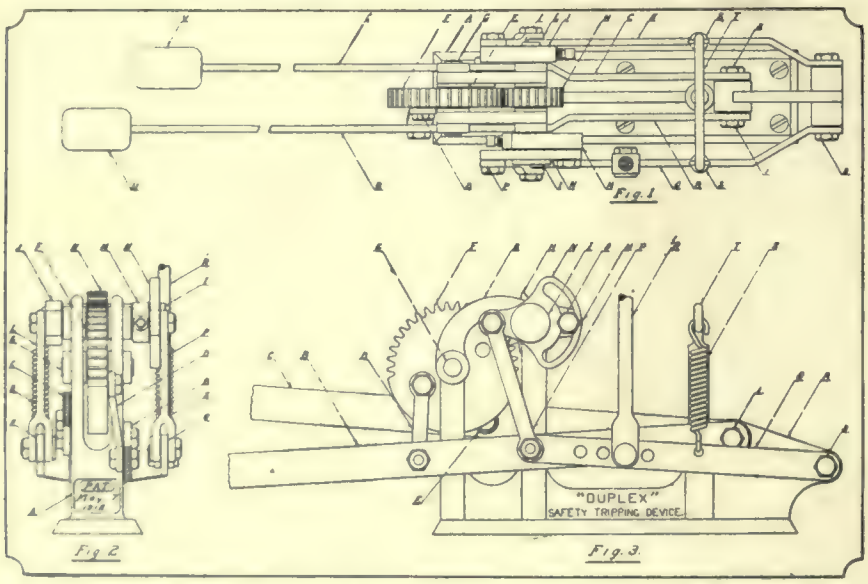
THE origin of a great number of crippled and disabled hands of men employed in the iron or sheet metal working trades, can be traced to the power press, where the starting and stopping depends entirely upon the attendant. The starting of a large percentage of different makes of power presses, is by the depression of a foot treadle below the bed of the machine, thus releasing the latch that holds the clutch out of gear, and allowing the crank-shaft to make a revolution.

### Tripping a Power Press.

Immediately the press is in action, the foot must be lifted or removed from the treadle, to allow the latch to return to its former position and prevent the crank-shaft making more than one revolution. In nine cases out of ten, when an accident takes place, the operator will say that the press "repeated." This may, or may not be true; but if the press did repeat, it was due largely, if not entirely, to a lack of caution displayed by the person in charge. When an operator removes his foot from the treadle each time he trips the press, it requires double the number of movements to perform his duties, and where from 10,000 to 30,000 operations a day are performed, it involves considerable muscular action in a person's leg or foot. On the other hand, where an operator does not remove his foot from the treadle, but allows it to return, after releasing the press, he must, to a large extent, retain considerable tension upon the muscles of his limb, in order to prevent the depression of the operating treadle, before the proper time. Now, one not familiar with the operation of power presses, has only to imagine what effect this muscular strain would have on the limb of a person, who is practically holding the weight of his leg up for from seven to ten hours a day. The writer has seen operators rise from their seats, and put their right leg in action, to remove the feeling brought about by the strained position.

### Careless Operation.

Another objectionable feature, and well worthy of censure, is the custom of a large number of press operators to allow the treadle to rise in amount just sufficient for the latch to operate the clutch pin. I have stood for considerable periods noting different operators, and quite a number allow only one-eighth of an inch contact, when there should be one-half inch. An observer can readily see that this perilous condition of affairs neither facilitates the operation, nor increases the rapidity of action, but on the contrary, leaves an opening whereby the attendant, when placing work in position, may unintentionally depress his foot sufficiently to trip the press, owing to his carelessness in not allowing the latch to return to its proper position. It is from this source, more than any other that the majority of casualties spring.




DUPLEX SAFETY TRIPPING DEVICE.

### Detail of Safety Device.

The accompanying drawings illustrate a "Duplex Safety Tripping Device," built, and patented by Jas. H. Rodgers, and Wm. J. Spence, both of Hamilton, Ont., which reduces to a minimum, the number of accidents traceable to the carelessness of the operator.

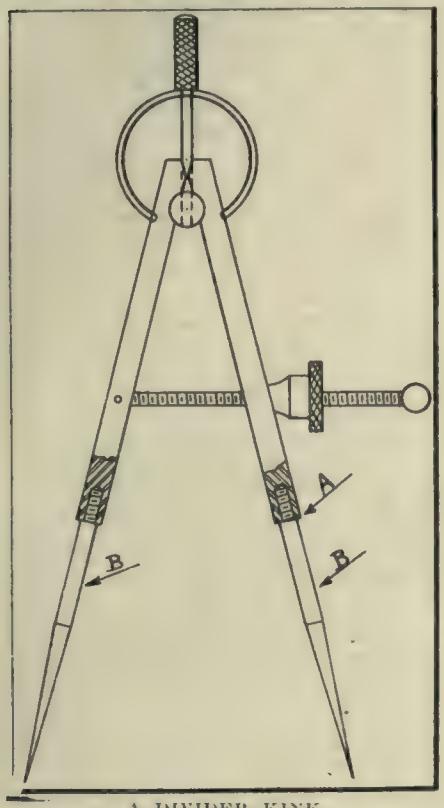
The drawing, Fig. 1, represents a plan; Fig. 2 a front elevation; and Fig. 3; a side view of the attachment. (A) is the frame casting, secured to the floor below the press, on which are mounted the various parts necessary to meet the required results. Fulcrumed at (1) and (2) are the two treadle levers (B) and (C) extending to the front of the machine, in the ordinary manner, and in a convenient position for the operator. The links (D) and (E) connect the treadles (B) and (C), with the gear (F) at diametrically opposed points. The shaft (G), on which gear (F) is secured, rotates through an angle of about 60 degrees. Meshing with gear (F) and secured to shaft (I) is the pinion (H). Secured to the left-hand end of the shaft (I) is the crank (J) which is connected with the lever (K) by the link (L).

On the opposite end of the shaft (I), and secured to it, is another crank (M). Outside of the crank (M), and free to rotate, is the slotted disc (N), held in position by the head on the shaft (I) and the stud (O). The purpose of the slot will be described later. The link (P) connects the disc (N) with the auxiliary treadle lever (Q), which is fulcrumed at (3). The trip rod (R) is secured to the auxiliary treadle lever (Q) in the ordinary manner. The tee post (T) carries the two springs (S) and (S). These springs are for the purpose of making the action of the mechanism positive, after the operator has tripped the press, by releasing the latch.

### Detail of Operation.

The foot is placed on the foot rest (V) and pressed downwards, lowering the treadle lever (C), and through the link (E), rotating gear (F) in a clockwise direction, thus causing the pinion (H) and the two cranks (J) and (M) to rotate in the opposite or contrary clockwise direction.

When the crank (M) has rotated through an angle of from 60 to 90 degs., governed by the length of the slot in the disc (N), the stud (O) comes in contact with the end of the said slot, and begins to rotate the disc (N). Through the link (P), auxiliary treadle lever




A DIVIDER KINK.

(Q) and trip rod (R), the latch is released by the continued downward pressure of the operator's foot, and back to position to stop the press after it has made one complete revolution. By lowering the other treadle (A) which by the above action has been raised ready for the next operation, the movement of the mechanism is again performed, but in an opposite direction, and with the same results. Every time either treadle is lowered, the press is released and automatically locked after making one revolution.

As will be seen by a glance at the drawing, the crank (J) and (M) will have passed the centre before the latch releases the clutch, and the spring (S) being under greater tension than the other spring (S), the mechanism will perform the movement independent of the operator. The muscular tension on an attendant's limb will, therefore, be reduced to a minimum, as he can allow the whole weight of his leg to go to the floor with the treadle, and remain until ready for the next operation.

**The Canadian-Cleveland Drill Co.** is now located at 80 Duchess Street, Toronto; their previous address having been 24 Adelaide Street W.

## A DIVIDER KINK.

By E. W. Tate.

ILLUSTRATED herewith is a method used in our shop by the foreman of the drills in order to economize in dividers. Taking his old dividers, the points of which had become badly worn, he cut them off at (A). After purchasing two scriber points, the legs of the dividers were drilled and tapped to receive the points (B), and the instrument was thus made as good as new.

## A MILLING AND DRILLING JIG.

By D. O. Barrett.

THE piece shown in Fig. 1 is a forked post supporting one of the levers on a gas engine. The lever is carried between the surfaces (b) and (c) by means of a case-hardened steel pin. The post rests upon the frame of the engine on surface (e) and is held by two ⅜ inch cap screws through the 13-32 inch drilled holes. In machining the piece, the first operation is to mill the surfaces (e). This is done by clamping the two bosses in a vise, with the tops resting on the bottom of the vise. The cutter is set to the correct height and the pieces can thus be duplicated. Clamping in the vise was found to be much simpler and fully as fast as if a special jig had been used.

Fig. 2 shows the jig for milling the surfaces (a), (b), (c) and (d). The body (A) of the jig is tongued to suit the grooves in the miller table and has

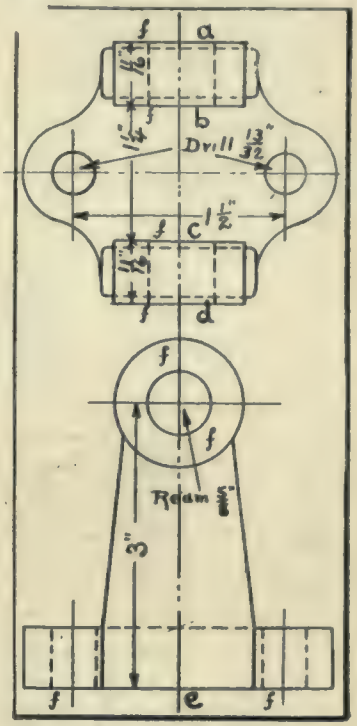



FIG. 1. MILLING AND DRILLING JIG.

an upright post at each integral with it. A steel vee-block (W) is held to the body by means of cap screws and dowel pins, while another vee-block (V) slides

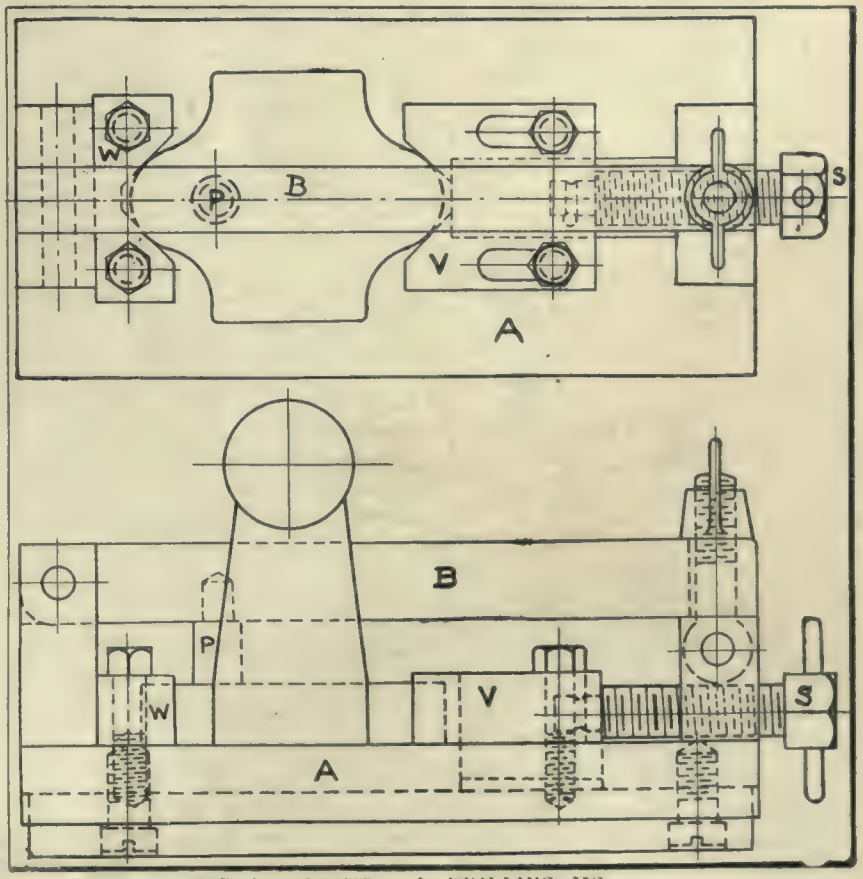



FIG. 2. MILLING AND DRILLING JIG.

in a groove in the body (A); being pushed forward or withdrawn by the screw (S). The bar (B) carries the pin (P) which rests on the forward end of the casting, pressing same firmly to the body. One end is hinged, the other being slotted for the swinging screw and thumbnut. The piece to be milled is set so that one end engages with the forward vee-block, the rear block being then tightened up by the screw (S). The bar (B) is next brought down and locked with the thumbnut.

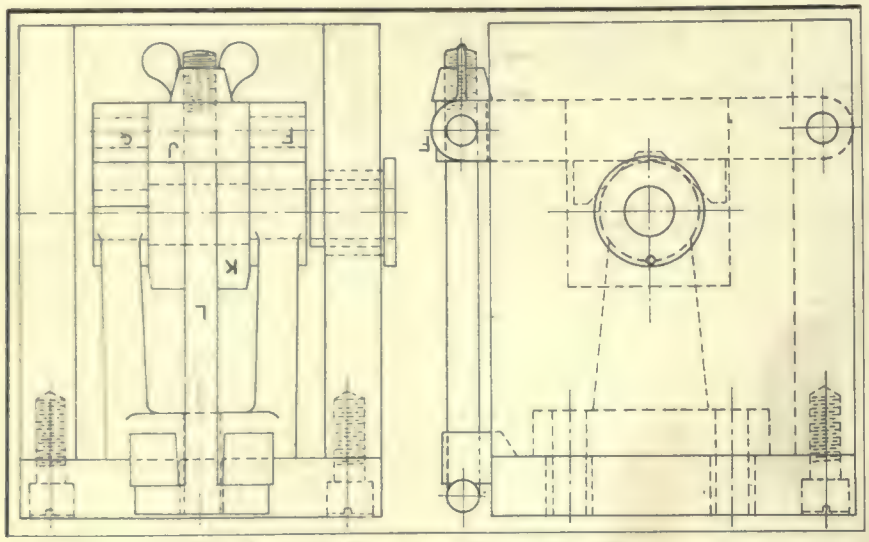
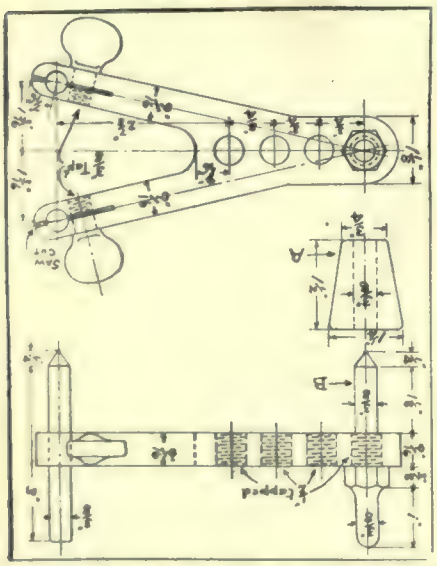


FIG. 3. MILLING AN D DRILLING JIG.

It was at first thought that the force required to feed the piece through the cutters would injure the screw (S); but the bar (B) had sufficient clamping effect and no trouble was experienced. One bad feature about the jig as shown is that the slots for the cap screws in



TOOL FOR LAYING OFF BOILER PATCH BOLT HOLES.

block (V) rapidly fill with chips, but this difficulty may be easily overcome by covering the slots with strips of sheet metal punched to take the cap screws.

After milling, the holes are drilled and reamed in the jig shown in Fig. 3. This is essentially a box with the front side and bottom removed. In order to machine the inner surface of the top, the latter was made a separate piece and then dowelled. In the top are two bushings for the 13-32 inch drilled holes, and in the side is the removable bushing for drilling and reaming the ⅝ inch hole. This bushing is prevented from rotating by means of a short pin which fits into a hole in the jig body. The bars (F) and (G) are separated by the block (K), which is about 0.005-inch less than 1¼ inches. Bar (G) is provided at the centre with a V which locates the piece to be drilled. Bar (F) is flat, in order to allow movement sideways, if necessary. The steel piece (J) is loosely fitted between the two bars to allow a slight relative movement in case the two bosses are not quite the same height. The block (K) is held to the bar (G) by screws. The T-headed bolt with thumbnut pulls down the casting against the finished inner surface of the top of the jig.

In placing the pieces in the jig, it is of course necessary to turn the latter over and drop the work in. The block (K), being bevelled, drops between the two finished surfaces and maintains the alignment sideways, while the vee on bar (G) locates the piece at right angles to this.

## TOOL FOR LAYING OFF BOILER PATCH BOLT HOLES.

By J. J. Smith.

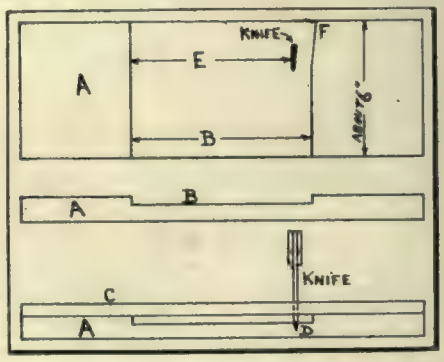
THE device here shown is a very handy tool for laying out patch bolt holes in locomotive boilers, or in fact any type of boiler. When the old patch bolts or rivets have been removed, the taper plug (A) is slipped over the pin punch (B) and the whole arrangement placed against the boiler plate, with the taper plug (A) in one of the holes. The two back punches are then adjusted by the thumb screws until the body of the tool is parallel with the boiler plate. These punches are next tapped lightly with a hand hammer, two identification marks being thus made from which a new patch can be marked. When each rivet hole has been marked in this way, the new patch is applied and the centres for the holes are readily marked by the punch B, being accurately located in setting the two back punches to the identification marks.

It will be seen that an error is almost impossible with this device. Moreover, it can be used for any number of holes in a patch, provided the original plate of the boiler can be reached by the two back points of the device. Extra tapped holes, into which the front point (B) can be screwed, are provided for use when desirable; as for instance, in locating two rows of bolts or rivets close together.

## CUTTING DOWN BELTS.

By Retals.

IF you have a belt which is too wide, and you wish to reduce the width by ½ inch or so, take a short piece of board (A), not more than 6 inches wide, and across the grain, cut a groove (B), of the same width as the belt about to be cut. The depth of this groove should be a trifle greater than the thickness of the belt. Next nail across the top a second board (C), of the same length and width, but only about ½ inch thick. Sink your pocket-knife blade down through the top board and far enough




CUTTING DOWN BELTS.

into the lower board to support the blade against the force of the cut, as shown at (D). As a knife blade tapers more or less from front to back, set the blade so that the space at (E) will be parallel. Cut away a clearance at (F) to allow for the taper of knife blade

and also to allow the strip of leather that is cut off to escape easily.

With a sharp knife, this makes an excellent job. The belt has to follow the groove; it cannot get away and will be of even width throughout, no matter what the length. This rig is cheap and safe and can be readily made up in 15 minutes. Start the belt through and if no one is neary-by to give a pull, grip one end in a vise and walk away from it.

## HYDRAULIC RIVETING OF BOILER HEADS.

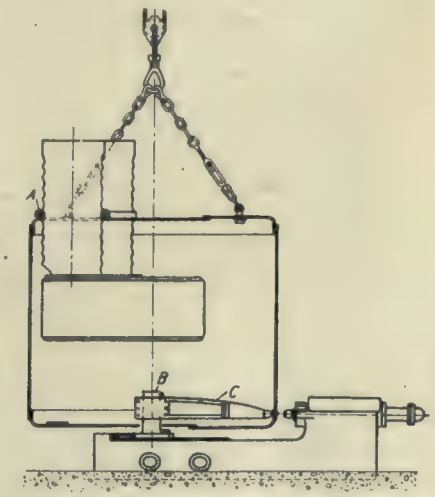
THE desirability of riveting by power all the seams of boiler shells is widely admitted. In practice, however, such a proceeding, although sometimes carried out, necessarily affects to some disadvantage, the disposition of one at least of the two flanged head-plates. It is usually possible to rivet hydraulically the circumferential joint at one head of a boiler, and to do so with the flange of the head-plate pointing within the boiler. The riveting-in of the other head-plate has, however, to be done under different conditions, for the first head being now closed, it is impossible to get the limb of an ordinary riveting machine within the boiler shell. If hydraulic riveting should be insisted upon throughout, there is ordinarily no other alternative than the reversal of the head-plate and its disposition with the flange pointing outwards.

### Disadvantage of Outward Flanging.

This arrangement of the second head-plate is undesirable for at least three reasons. In the first place, the space formed between the fillet of the flange and the cylindrical shell is found to gather sediment and to be subject to excessive corrosion. Secondly, for the same internal capacity, the length of the boiler overall is increased by an amount equal to the depth of the flange. Thirdly, the reversal of the head-plate does away with one of the two caulking edges. The caulking, in fact, has to be confined to the external seam, for there is now no suitable edge in the interior. These facts are of sufficient importance in many cases to weigh down the advantages obtained from the hydraulic riveting of the second flange, and in practice it is usual to revert to hand riveting for this seam, and to arrange its flange pointing inwards like the other.

### New Type Riveter.

When in Dundee, recently, says "The Engineer," a representative of this journal was shown a new system of boiler riveting at the engine works of the Caledon Shipbuilding and Engineering Co. This system is in accordance with the ideas of Mr. Thompson, sen., and the machine used in it has been designed and constructed by the company. The accompanying cut clearly illustrates the essential details of the method. In this case a single-ended boiler is being dealt with, and here the first steps are the riveting-in of the furnace door head-plate by the usual means and the complete assemblage and riveting of the furnace flues and combustion chambers. The flues and their chambers are placed in the interior of the shell and passed upwards until about half the length of the flues project through their flanged holes in the head-plate. They are supported in this position by means of bent clips engaging over the flangers and within the flue corrugations as shown at A. The rear head-plate is provided with a central hole, and is disposed horizontally on



HYDRAULIC RIVETING OF BOILER HEADS.

the special riveting machine with its flange pointing upwards. The post B of the riveting machine passes through the central hole, and to it there is attached an arm C carrying the holding-up rivet die.

The boiler shell is now dropped over the rear head-plate thus arranged, and riveting proceeded with in the obvious way. The withdrawal of the arm C, after operations are completed, is effected through the hole in the head-plate. This hole is finally closed up with a patch. The post B is adjustable lengthwise on the bed of the machine, and the arm C can be lengthened or shortened so as to permit various diameters of boilers to be dealt with. The machine we are informed, has given every satisfaction since its installation. It is, of course, equally applicable to double-ended as to single-ended boilers.

## FALLACIES ABOUT CYLINDRICAL GRINDING.

ONE popular notion credits some particular virtue to a grinding machine because the work table traverses, and another that machines on the market where the wheel traverses instead of the work, have again some particular virtue in this respect over the former.

Now, it does not make, in my opinion, one particle of difference whether the work traverses by the wheel or the wheel traverses by the work, so long as other things are equal. If the designer in either case has hit upon a plan for the various mechanisms in connection with the machine, whereby he gets accuracy, whereby he is assured of accurate diameters at the will of the operator, and does get accurate work upon the machine, it makes absolutely no difference whether the wheel traverses or whether the work traverses. We believe that we have selected mechanism of such a nature as to secure accuracy of diameter at the will of the operator and that we could not have selected this mechanism if we had been obliged to do so with the wheel traversing.

This is a matter of design, and it is, in my opinion, a sign of ignorance on the part of any mechanic to advocate either method of traverse as being better than the other. If, in his criticism of one or the other, he shall point out some defect in the design or arrangement of the parts whereby accuracy can or cannot be secured, there will be some intelligence in his conversation; but if he points out that one machine must be superior to the other because the table does not move by the wheel or because the wheel does not move by the work, in my opinion, it is a sign of ignorance of the question. It is well for us, therefore, not to be too cock-sure which machine is the best until we know all about both.

Another popular fallacy is that in order to secure a wheel to grind fine surfaces, the wheel must necessarily be of fine grain. This is a common mistake, and leads to a great deal of misunderstanding. It is also a mistaken notion that it is economy to avoid trueing the wheel. On the other hand it is real economy to true the wheel perfectly and often. Of course, we are referring now to cylindrical grinding, and in any talk of this kind it is well to understand the difference which may exist between cylindrical grinding and any other kind.

There is another popular fallacy that work should be turned very close to size in order to grind. It is assumed that the grinding machine can remove only a small portion of metal and the believers continue to make the mistake of spending valuable time and money in turning work accurately on an engine lathe. The facts are, that the present

day grinding machine is so designed, with sufficient power, rigidity and accuracy, that the work need not be turned accurately, and the turning machine to-day is merely a roughing tool in fact. It remains simply for the public to come to the understanding of the fact that the grinding machine makes entirely unnecessary, accurate turning, and thereby is in a position to decrease the cost of producing ground work and at the same time give accuracy.—C. H. Norton in "Grits and Grinds."

## THE NARROW GUIDE ON MACHINE TOOLS.

By Alfred Wildgoose,
in "Practical Engineer."

ANY attempt at modification or alteration in the design of a machine, whether it be a machine tool or otherwise, which will make for improvement either in working efficiency, ease of manipulation, or utility, or which will reduce the cost of the machine or article produced by that machine, should be encouraged. The prevailing eagerness exhibited in this connection as exemplified by the innovation frequently presented in new designs or re-designed tools occasionally results in the adoption of an idea which savours more of a selling or talking point rather than of a decided improvement. In the opinion of some, this might be said of the narrow guide, as introduced and boomed in machine tool design some years ago. In contemplating or deciding on a new departure one would assume that experience had shown the necessity and desirability of some alteration. At times, however, improvements suggest themselves spontaneously, and ultimately prove to be of real value, although their necessity has not actually revealed itself or been apparent in actual working. The latter remark might possibly apply to the narrow guide.

At the present time there are thousands of lathes and other tools in operation with guiding surfaces for the movable slide, of the ordinary and well established form. In adopting the newer and questionable type of narrow guide it is a question whether the relative efficiencies and strengths of the two forms were carefully investigated, and it is a further question whether this investigation did prove detrimental or prejudicial to the older type. I do not remember having seen the results of any experiments proving the superiority of the narrow or the inferiority of the other design of guiding ways.

### Comparative Results.

Examining the many designs now available, no definite idea can be gathered as to what is supposed to constitute a narrow guide. A careful study would indicate that many of the firms who have adopted the principle are not quite convinced as to the advantage of presenting us with a narrow strip of metal largely lacking in strength and stability. Further, if the principle is good, and better than the old-established one, why is its application limited in the majority of cases to the main carriage or sliding unit? Surely if it is such a boon it might be worthy of adoption in the several parts usually embodied in a machine tool, where the conditions of working are much the same. At least, those makers who adhere to the more conventional view are more consistent in its application. In the absence of a more general use of the principle respecting any particular tool, the conclusion naturally arrived at is that it is either more costly, less convenient or lacking in other respects. Experience with both designs fails to show an appreciable advantage in any respect with the newer type, while many of the applications exhibit several bad features.

There are at the present time many lathes and other tools of the ordinary type whose ease of manipulation it would almost seem impossible to improve, and whose efficiency could hardly be surpassed. They have been in constant operation for twenty years, and in some cases more, with a minimum of attention, and still produce excellent work. In face of this, it appears almost idle to transfer our favors from a design having claims of so justifiable a character to one which at best is in the nature of an experiment, having yet to prove the justification for its existence. It has been suggested that the new design was called for by the introduction of high-speed steel, and, although many improvements with respect to general rigidity were necessary, surely the subject under discussion cannot be conceded to be one of them. Instead of increasing the stability several of the types present an inherent weakness.

True there are tools by undoubtedly good firms on which the narrow guide is embodied which have proved themselves to be machines of high value in many respects, and in the general all-round satisfaction given by these tools due to various modifications and improvements the narrow guide might be unconsciously thought to have contributed thereto. Yet, in all probability, the original form would have shown itself of equal value, and very likely in the course of time been more appreciated.

### Infancy of Narrow Guide.

This, of course, remains to be proved, for after all the narrow guide is, comparatively speaking, still in its infancy, while its predecessor has not only stood the test of time, but has stood it well. If at the end of a similar period the new departure should come out with equal honors, then the justification for its introduction and existence will be established, but it is the writer's opinion that such cannot be said at the present time. The position might be discussed from the theoretical point of view, which, as a matter of fact, has already been done with varied results, but in any case the best test is the practical one, for there are conditions which occur in actual working which might not be taken into account or might even be ignored when treating the subject theoretically. Can it be shown conclusively by practical experience or unbiased experiment dealing with all points that the narrow guide is superior? So far as I am aware this has not been done. If it can, then it should be adopted universally, but the writer up to the present is content to favor the perhaps old-fashioned, but still highly satisfactory, arrangement. The opinion of other readers on this point would be of undoubted value to the machine tool industry.

## ANALYSIS OF BROKEN RAILS.

AN engineer of the New York Central and Hudson River Railway has analysed 229 broken rails on a main line, the great majority being on high-speed lines and on the near side. There were more breakages on straights than on curves; 184 were of the comparatively recent 100 lb. rail and 45 of the older 80 lb. section; 17 were caused by defects in the equipment, 149 by flaws, and 53 by unknown causes; 240 partial fractures were divided almost equally between fast passenger lines and slow goods lines. The breakages were also equally divided between the heavy and lighter rails. On the former, of the 45 base fractures — principally half-moon pieces out of the base—34 were over the ties; and of the 26 similar failures in the lighter road 17 were over the ties.

The cause of this large percentage where the metals are supported is attributed to the material not being strong enough; to the section not being big enough; or to the stress being too great under the conditions of the support on the tie to which the rail is exposed. Of all the fractures, whether partial or complete, only two were discovered by outsiders, while 298 were found by the company's men, and 169 of the complete fractures were notified by the breakage of the line circuit.

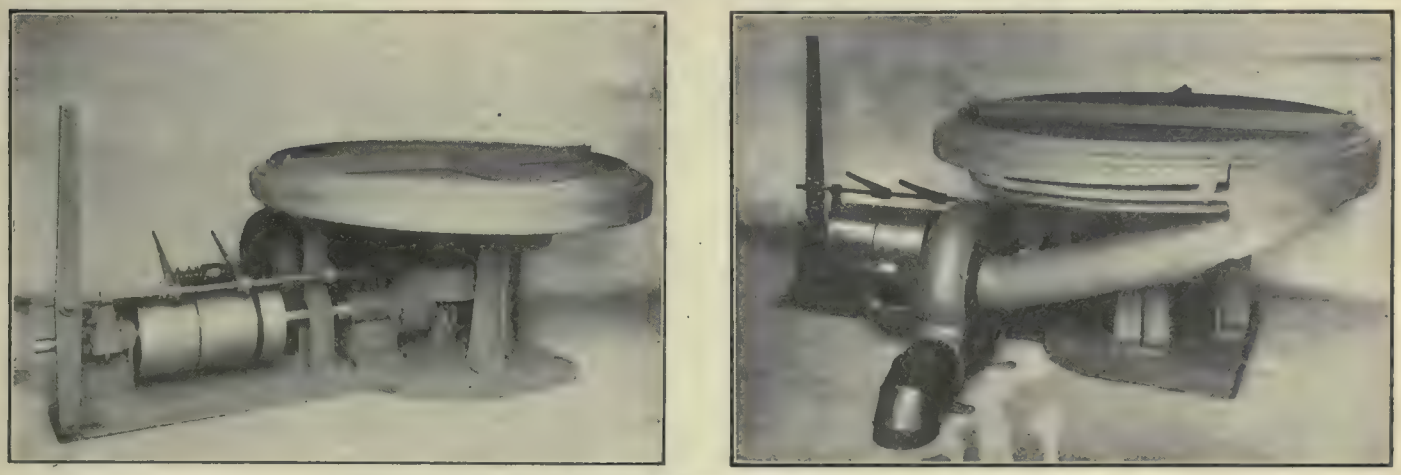
**Veritys, Ltd., London, Eng.**, are sending out List No. X159. This deals with the firm's line of portable electric drills, suited for continuous service.

# DEVELOPMENTS IN MACHINERY

**A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.**

### VERTICAL SPINDLE GRINDER FOR JOINTING AND FLATTING.

ILLUSTRATIONS show the No. 19, 53 inch. vertical spindle disc grinder manufactured by Charles H. Besly & Co., Chicago. This machine is for jointing or flatting such work as stove doors, foundry flasks, meter cases, large gear cases, split shafting bearings, etc., where it is not necessary to grind to size or any given angle. The work is laid on the horizontal disc wheel and ground by gravity feed. Where work is too light to grind satisfactorily of its own weight, the practice is to lay on weights. Usually, a large number of pieces (as many as size of disc wheel will accommodate) are ground simultaneously. As soon as one piece is finished it is taken off the wheel and immediately replaced by a rough piece. In this way the disc wheel is loaded practically to its limit at all times. In jointing castings for split shaft bearings, as many as thirty-five castings are grinding at once, a laborer being employed to put the work on and take it off the grinder.



VERTICAL SPINDLE GRINDER FOR JOINTING AND FLATTING.

#### Constructional Features.

An exhaust ring, cast hollow and slotted for exhausting the grinding dust, extends around the outer edge of disc wheel. This exhaust ring tapers from nothing to about five inches by five inches at the point where exhauster is connected, in order to give uniform suction all around the disc wheel. A removable guard ring, cast in sections, is provided around the disc wheel, projecting 2 inches above the grinding face. This prevents the work flying off the disc wheel while being ground, and aids in properly exhausting the grindings. Suitable wooden bars, as shown, are usually secured to this guard ring to prevent the work revolving with the grinding wheel. A section of the exhaust ring, 26 inches wide, is removable, so that free access may be had to the edge of the disc wheel at this point, for grinding work which may have bosses or lugs projecting beyond the plane of the ground surface. This feature is very desirable, especially on stove work.

The disc wheel, of wrought steel, 53 inches diameter by 1¼ inches thick, is machined on both sides so that both faces of wheel may be set up with circles. When the circle on one face is worn out, the disc wheel may be turned over and the opposite circle used. The machine is usually furnished with a spare steel disc wheel, and a suitable press is also furnished so that one wheel may be set up while the other is in use on the grinder. In this way the grinder may be operated continuously. This is a great advantage over the old style vertical spindle grinders equipped with only one wheel, for when the disc wheel must be set up while in place in the grinder, the latter is necessarily idle several hours each time a circle wears out.

The disc wheels weigh 800 pounds each. For convenience in handling they are drilled and tapped to receive eye bolts for connecting to crane or hoist hook. The grinder and press are usually served by a chain hoist suspended from a suitable trolley. Bevel gears are fully enclosed in a cast iron gear case and run immersed in oil. All bearings are bushed. The horizontal shaft carries tight and loose pulleys, 12 inches diameter for an 8 inch belt. A countershaft is not necessary as the machine may be driven direct from line shaft or motor, above or below. A suitable pulley for driving the exhauster may be mounted on horizontal shaft as shown in illustration.

The grinder is 34 inches high and weighs complete with two disc wheels and press, 6,000 pounds. On work for which it is adapted, this grinder is a real cost reducer as will be noted by the following examples.

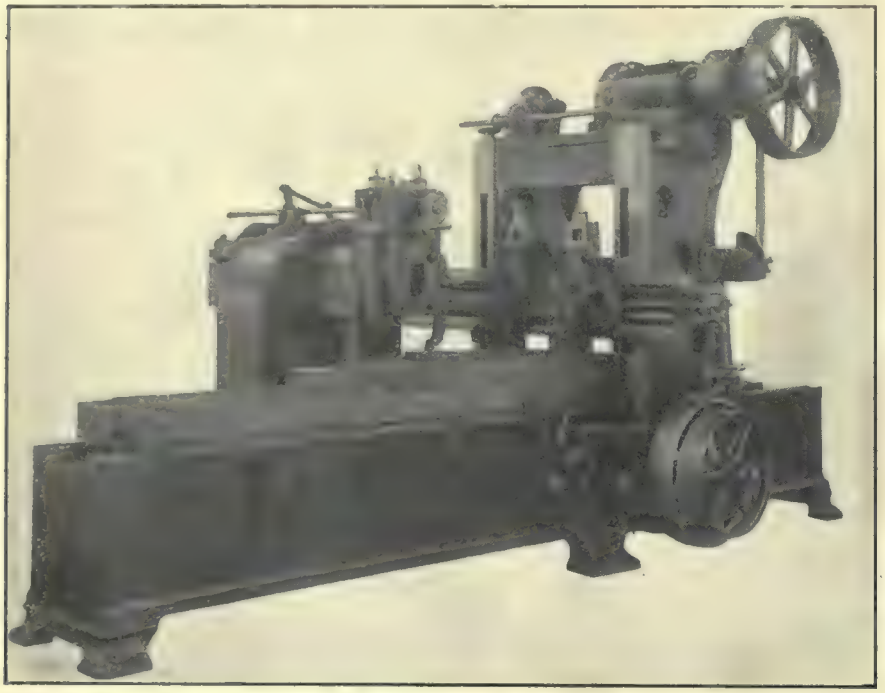
On jointing cast iron split shaft bearings, it is claimed that No. 19, 58 inch Besly grinder does the work six times faster than formerly, where one man operated two milling machines. For facing narrow ribs on cast iron boxes, so large that a 53 inch disc wheel accommodates only four boxes at a time, this grinder, it is claimed, does the work twenty times faster than former profiling process. Again, for facing spots on power pump bed plate castings, 33 inches by 38 inches, weighing 115 pounds, ten times faster than former planing process is claimed.

### SPECIAL PLANER ARRANGEMENT.

OUR illustration and description refers to a 28x8 Planer built by the Rockford Machine Tool Co., Rockford, Ill., and equipped with a special housing carrying two toolholders.

The machine was designed to plane bases for a well known line of upright drill presses, and is equipped with the

Rockford standard four-speed drive, giving four cutting speeds with a constant return, same being arranged for belt drive direct from the line shaft, thus eliminating the usual countershaft. The special heads are mounted on a ram of square construction, and the feeds are driven from a friction at the rear of the machine mounted on the intermediate shaft of the planer. The feeds are operated and reversed by the trigger gear shown on the front of the head, within easy reach of the attendant.



SPECIAL PLANER ARRANGEMENT.

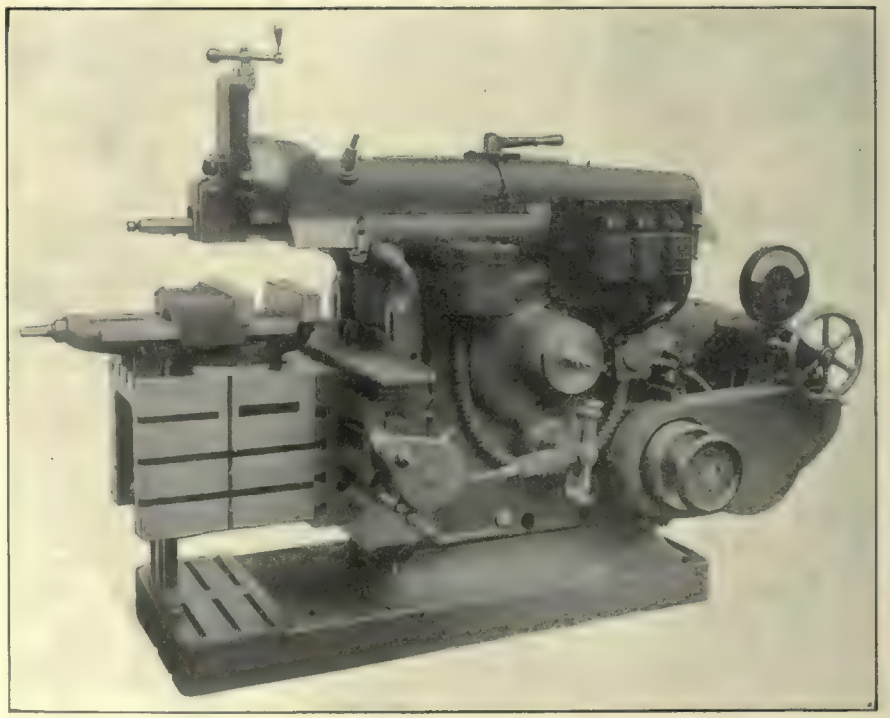
The operations of this equipment are very simple. The flat T slotted base is planed and finished with the two heads on the regular cross rail. While this is being done, the rear head on the special attachment machines the top of the hub for supporting the drill press column and the front head planes the pad for the outer bracket at the rear end of the base. We understand that the machine is handling the particular job for which it was designed in a very satisfactory manner and in one-half the time previously required for doing the same work on a similar machine, but without the special attachment, which, of course, necessitates taking the cuts on three levels at different settings.

## NEW TYPE HIGH DUTY SHAPER.

IN the further development of Gould & Eberhardt's line of "High Duty" shapers, and in response to the demand for designing machine tools for the more modern uses of high speed steel, in steel mills, railroad shops and drop forging shops, this company of Newark, New Jersey, has recently designed and have under construction a number of new "Invincible Type" 24 inch shapers as shown in the illustration. These machines will have a great advantage over previous designs, owing to the new patented construction for raising up the main bull gear, which greatly increases the shaper's mechanical efficiency. In addition to this new feature, there will be found the following improvements:—Outside diameter of bull gear hub increased from 3¾ to 6 inches; larger V bearings and gib arranged so that there is a solid metal to metal construction on each side of ram bearing: solid top main lever; hole being provided in frame for key-seating; shafting overhang of crank pin reduced to a minimum; crank pin thrust taken by solid walls in bull gear similar to ways of ram, no straps or bolts being necessary; patent "Double Train Gear Drive" ratio increased; new front table support of heavier construction; and the head, ram and frame made of more massive construction.

The bull gear hub centre has been raised up nearer the ram 4¼ inches from its present position in the standard 24 inch shaper. Not having changed the position of the fulcrum of the lever, this means that the work arm of the main lever has been lengthened in relation to the load arm, which greatly increases the mechanical efficiency of this reciprocating lever that imparts the power to the ram through the crank pin located on main bull gear. Due to this change in position of the bull gear hub centre, it was necessary to reconstruct the bull gear, which construction, we understand, is entirely covered with patents that have been allowed.

This machine weighs 4,800 lbs., and our illustration shows it direct connected to a "Reliance" variable speed motor, having automatic starter and dynamic brake control.



NEW TYPE HIGH DUTY SHAPER.

## A METHOD OF CASE-HARDENING.

CASE-HARDENING is an art of many tips and methods. Even in large workshops it is far from having reached the status of an exact practice, and in smaller places, or with irregular quantities going through, it is often poorly done. In many instances where it could be applied with advantage, it is neglected. A maker's catalogue on the subject arrested attention, and a careful reading proved it to be quite a treatise—very clearly written, with good working rules, and some homely, forcible advice to working mechanics. One of many satisfactory features of this little publication is the absence of any pretence that buying the makers' goods in preference to others will solve all troubles. On the contrary, you are very candidly told that, in addition to good material and a good method, you must apply carefulness and intelligent observation, and acquire skill in the art before good results can be expected. The following condensed reprint is well worth reading. Those practically interested should, however, send for the full pamphlet:—

### Case-Hardening Materials.

The very best results in case-hardening can only be obtained by an apparatus which will ensure a uniform heat. There seems to be a general opinion that different qualities of case-hardening materials are necessary for different kinds of work, but experience of over twenty-five years shows that hydro-carbonated bone black is best suited for all classes of work, except where the merest surface case is desired and uniformity is of no material value, and then a common bone meal of the cheapest quality may be used.

Granulated raw bone is still used in some few places, but it is not economical. Carbon is the essential property necessary, and where raw bone is used, the process will not commence until it is converted into charred bone, otherwise known as bone-black or animal charcoal. In converting raw bone into bone-black there is a loss of slightly over one-third in weight, consequently you must add one-third to the original cost; the cost of fuel in charring; the time, etc., to the fire cost of raw bone in comparing it with a bone-black.

The ordinary forms of bone-black are not very extensively used owing to the fact that bone-black absorbs moisture very largely from the atmosphere, and moisture is very detrimental to the best results in case-hardening. The percentage of moisture absorbed depends very largely on the age of the black, humidity of the atmosphere, and other causes which make ordinary bone-black a very un-uniform material and the results correspondingly un-uniform.

Burnt leather is used somewhat, but is very troublesome and quite expensive when cost of preparing is taken into consideration. Of all forms of burnt leather, old shoes undoubtedly give the best results as to color. Care should be taken in using old shoes that metallic nails are not in the charred leather, as they will adhere to the work, and sometimes become so hard as to be removed only with the greatest difficulty. Leather, like ordinary bone-black, must necessarily lack uniformity, as it is waste. The material used should be as free as possible from soft dust, and the grains should be hard and firm, and under all circumstances the bone should be free from slate, slate being the result of over-charring.

### Case-Hardening Method.

A method of case-hardening which gives first-rate results for hard surfaces is:—Pack the pieces in wrought iron boxes; for small work, say screws ¼ in. to ¾ in., or smaller size pieces, use a box 4 in. long, 4 in. wide, and 8 in. deep. Put a layer of H.C. bone-black in the bottom, then a layer of the pieces to be hardened, and repeat until the box is filled to about 2 in. from the top. The remaining space can be filled with black that has been used, providing it is free from moisture. Then put on the covers and lute with clay. It is necessary that the boxes should have some little vent in order that the excess of gases caused by expansion should escape. The clay will dry and crack, and permit this vent. In packing, be certain that none of the pieces come nearer to the sides of the boxes than ½ in. In packing pieces with irregular surfaces, such as screws, or with interior surfaces, such as the threads of nuts, the bone-black should be tamped into the crevices but only lightly and not too tight.

The boxes should then be placed in a suitable furnace, or on a cricket, so as to permit a uniform circulating heat on all sides. The heat should be gradually raised to a cherry-red, and retained at that as nearly uniform as possible for three houre or upwards, according to the size of the pieces and the depth of case desired. As the bone possesses the case-hardening power, the larger the pieces and the deeper the case, the greater the quantity of bone and the longer the heat necessary. For pieces 4 in. to 6 in. diameter, the work should be packed in the H.C. bone-black, permitting at least 2 in. to surround each piece, the heat should be raised to a bright orange, and kept at that temperature for three to five hours. The time allowed depends upon the depth of case required and the grade of iron or steel used. Steel can be hardened the same as ordinary iron, but the time and quantity of bone used must be about one-quarter greater to obtain the same results.

The pieces, when ready to remove from the boxes, should be immediately dumped into clear, cold water, salt water being preferable for the larger pieces, because giving the hardest case. It is best to dump the entire contents of the box into the bath, holding the boxes as close to the surface of the water as possible, so as to prevent the air from striking the pieces. If the air does strike the pieces they will assume a black or blue-black color, so that when a bright surface is desired, it is necessary that no air shall strike the pieces. This process of preventing the air from striking the pieces is one requiring the nicest care, and no one can expect to do it properly without practice. A sieve placed about half-way down in the bath will permit the bone to separate from the pieces. The bath should be either large enough to guarantee the coldest possible water, or else so arranged that constant running water is obtained. In cases where special work was being turned out in warm weather, ice has been introduced in order to obtain a low temperature.

### Colouring.

Good colors can only be obtained on nicely polished, clean pieces. Badly finished, oily work cannot be colored properly. For colors, pack the pieces as described before, except that nothing but fresh H.C. bone-black should be used. The boxes should be placed in the furnace as before described, and the heat gradually raised to a cherry red, and retained at that temperature for three to four hours. If the heat is too intense there will be no color. The time can be increased or diminished according to the size of the pieces, and can only be determined by experience, the time given being for pieces about the size of ¾ in. screws. In the bath for colors, soft water is preferable. Running water should be used, the inlet about half way down and the outlet 4 in. from the bottom. The water must be kept as cool as possible.

If ordinary streaked black or blue work is desired, the pieces should be dropped into the water at a distance of from 1 ft. to 5 ft. above the surface of the water, the distance being according to the color desired, and ascertained with a little experience. For bright colored work, connect an air pump with your supply pipe, so that when the pump is in operation, the air and water mix as they come into the bath together. When dumping, hold the box as close to the surface as possible, so as to permit no air to strike the pieces. When the pieces are dumped, have a stream of air and water running into the tank. Increasing and diminishing the volume of air gives different effects. As the work comes

from the boxes free from the bone, the pieces should be thoroughly rinsed in fresh water, wiped perfectly dry, and then slushed with oil. Rolling in sawdust is a good method of drying.

**Annealing.**

The process of annealing is simpler and less difficult than that of case-hardening. It requires less hardening power from the bone, and consequently the waste or used bone from case-hardening can be used in this process. In fact, the H. C. bone-black can be repeatedly used again and again, adding each time a little waste that has not been used more than once. The pieces should be packed in boxes, the same as for case-hardening, excepting that it is not necessary to use such care in keeping them thoroughly apart. The boxes should be placed on the oven and heated through to a cherry-red. Remove the boxes without permitting them to remain too long in the ovens, and cover with ashes, charcoal or waste bone-black until they are cold. Under no circumstances should the pieces be removed from the boxes until they are thoroughly cooled. This process is for a soft anneal.

Owing to the various methods of case-hardening, the different results desired and the difference in the metal, no one set of rules can be formulated that will meet all requirements. Experience must guide the operator to a great extent. If the pieces do not harden sufficiently at one operation, they should be repacked and hardened again in precisely the same manner as at first, and there is no limit to the number of times the operation can be repeated.—From a pamphlet on "Case-Hardening," issued by W. H. Pelfryman & Co., Liverpool, manufacturers of Hydro-Carbonated bone-black.

## SMOKE PRECIPITATION BY ELECTRICITY.

A DEVELOPMENT is being made in the United States of a process for electrically precipitating the suspended matter from smelter smoke and fumes, and the dust from rotary kilns in cement works. The general principle is not new, and has been applied successfully in laboratory work by different investigators. The first experiment on a working scale was at the Hercules powder works, where sulphuric acid separated as a dense white cloud of suspended particles. Being so fine it was extremely difficult to remove by filtration, but was easily precipitated by electric current. It was next tried in treating the mists escaping from boiling sulphuric acid used to dissolve silver. At the Balakala works, the gases from pyrites-roasters and matte-roasters are treated at the rate of 250,000 cubic feet of gas per minute. The material is a mixture of solid dust and fume, with liquid sulphuric acid and the gases are highly charged with water vapor, which dilutes the acid and produces a muddy deposit. The gases are treated in flues of sheet lead.

The plant of the Riverside Portland Cement Co., was made the basis of great complaints by fruit growers on account of the fine dust thrown out by the rotary kilns and carried to great distances over the orchards. A plant was installed to treat the product of one kiln—50,000 cubic feet of gas per minute—and the results were so satisfactory that the other nine kilns have been equipped in the same way. The process now being applied also to the removal of dust from blast-furnace gas and producer gas, was developed in the chemistry department of the University of California by Mr. F. G. Cottrell, but the university could not undertake its commercial exploitation, therefore, a special board or "corporation" has been organized to do this. This board will operate like any business concern, except that instead of paying dividends to the stockholders all net profits will be devoted to scientific research.

## TORONTO STRUCTURAL STEEL CO.

ANOTHER vision of Sir Max Aitken, conceived during his trip through Canada, is about to assume definite proportions in the re-organization of the Toronto Structural Steel Co. The great difficulty experienced by builders in obtaining sufficiently large quantities of structural steel and the fact that the importation from the United States of this article is on the increase led him to believe that the development of the industry could be made very profitable, and so as a nucleus he and several other prominent financiers obtained an interest in the Toronto Structural Steel Company, and had the capital increased from $200,000 to $1,000,000, to be divided $500,000 in preferred and $500,000 in common stock. More than half of this has already been purchased by Sir Max Aitken's friends, and it is expected that the balance will also be disposed of privately, although a small public offering of the issue may be made at par. The stock will bear dividends of 7 per cent.

The present plant of the Toronto Structural Steel Co. is on Atlantic Ave., and has a capacity of 3,000 tons of structural steel a year. A new plant will be erected near Weston, with a capacity of 15,000 tons a year and provision for double this amount. Seventeen acres of land have been acquired. Among the directors of the company will be Messrs. Alex. Longwell, Geo. Gowanlock, F. P. Jones, of the Canada Cement Co., and R. M. White, of the Royal Securities Co.

## C.N.R. SHOPS AT TORONTO.

IT is only a question of a few months now before work is started on the new Canadian Northern shops for the Toronto district. They will be located to the southeast of the new Canadian Northern Model City at Leaside. In all probability seven or eight hundred men will find work as soon as the shops are opened, and this number is likely to be doubled, if not tripled, as the business of the Ontario division of the line increases. Sir William Mackenzie recently stated that, although he could make no definite announcement as to the commencement of the work, it was quite probable that operations would begin ere the present year was out.

No freight cars will be built at the new shops, as the company finds it cheaper and better to purchase new cars from the car companies. Large repairing works, both for cars and locomotives, are, however, planned, and well-founded rumor has it that extensive locomotive-construction shops are on the tapis.

**Provision for Employes.**

Provision has been made for the housing of the workmen in the new Leaside townsite. Immediately adjacent to the shop site a number of streets have been laid out in smaller lots than is common in the townsite, while one is so divided as to be intended obviously for a business street to supply the needs of the C.N.R. employes.

The Canadian Northern is also contemplating the formation of a new station at the southeast of the new Leaside property, to provide easy access to North Toronto for the suburbanites. The precise location of this is still uncertain.

## HIGH PRESSURE GAS FOR MANUFACTURING.

IN a paper on "High Pressure Gas for Manufacturing Purposes," Mr. A. W. Onslow states that experience has shown that, with gas at 50 cents per 1,000 cubic feet and coal at $4.90 a ton at the furnace, there is very little difference in the cost of the two methods of heating; the difference being in favor of gas, when used for practically all commercial purposes, provided the gas furnaces are designed with a view to the greatest economy. There are instances where gas is infinitely cheaper, cleaner and more suitable in every way. The exception is with large furnaces when immediate contact of flame with refractory material is difficult.

# FOUNDRY PRACTICE AND EQUIPMENT

**Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.**

## NOXIOUS GASES IN CUPOLA OPERATION.

FOUNDRIES are often heard to complain that men working near the cupola are troubled by escaping gases, especially if at work near the tap-hole or the charging platform. This is disagreeable as the men become sick and lose in efficiency.

### Tap Hole Trouble.

The opinion has often been advanced that the escape of gas from the taphole and the charging platform is due to the same causes. This is not true, however, as is shown by the very fact that in some foundries only one of the two places mentioned gives trouble. It seems strange that complaints were much less frequent in former years with the old type of cupola, and that the more recent cupolas with forehearth give most cause for trouble. The reason for this may be, that the blast from the tuyeres enters through the coke charge, and reaches the forehearth. In passing over the coke, the blast absorbs a considerable quantity of bad combustion gases which mix in the forehearth and give off a very obnoxious odor. There is no natural outlet for this gas, it escapes through every crack and leaky opening in the forehearth lining, and more so, since the air in the forehearth is under pressure.

Each forehearth has, however, one or more peep-holes, and since these do not close airtight in the majority of cases, we have here the greatest and most dangerous escape for gases. Attempts have been made to remove these gases artificially, but without result. The Krigar furnace tries to remedy matters by connecting the peep-hole with the blowers direct and thus blow fresh air into the forehearth; but even this method is not satisfactory, and the best that can be done is to make the lining of the forehearth as airtight as possible.

### Charging Platform Trouble.

The second source of trouble lies near the charging platform and is more serious, since the quantity of gases escaping is much greater. Here, also, the older cupolas without spark chambers, were strangely free of this nuisance; but the cupolas with spark chambers give much trouble. This does not mean, however, that the spark chamber is superfluous. On the contrary, it is an absolute necessity so as to eliminate the dangerous emission of sparks. It is also a fact that the proper arrangement of the spark chamber will little influence the emission of gases. The trouble was in most cases that the spark chamber was arranged directly above the floor of the charging platform, so that all iron and coke charges had to reach the cupola by way of it. Since the spark chamber is, however, the real collecting point for furnace gases, it was natural that the imprisoned waste gases sought their way out through the charge opening of the spark chamber and reached the charging platform direct, molesting the men there.

Within the past few years, foundries have built their spark chambers starting at a height of about 7 feet above the charging platform floor. The charges are, therefore, sent to the cupola without passing through the spark chamber. The escaping cupola gases, however, having a uniform rate of speed due to the diameter and construction of the furnace, go directly to the spark chamber, passing the charge opening without escaping to the platform. The cost of this type of spark chamber is of course somewhat greater than the first type, but the results, reckoned from the health and efficiency standpoint, more than pay for the higher cost.—Eisen Zeitung.

## SOUTH AFRICAN STEEL WORKS.

AT Dunswart, East Rand South Africa there is already a small but well-equipped and busy iron and steel works, with a capacity of 20 tons of finished product per day. It turns out rounds, squares, flats and angles, as well as rails up to 20 lb. per yard weight, tube mill pegs—an article in considerable local demand—and also concrete reinforceing bars, using as raw material iron and steel "scrap." Up till lately "scrap" could be had for the carting away, as it was only so much lumber at the mines. The price at which the new South African Steel Corporation has purchased all the accumulations of the South African railway is $5.00 per ton delivered. At this price all the "scrap" of the railways has been secured for the next sixteen years.

## LIFTING MAGNETS.

EXPERIMENTS recently made at the Zenith furnace in Minnesota have resulted in practically doubling the capacity of the lifting magnets employed for handling pig iron. Formerly this method of handling furnace pig iron was restricted to the quantity that could be lifted by the ordinary plan of picking up the iron from the ground or floor, and with the pigs lying flat, only a relatively small number would adhere to the magnet. In these experiments the pigs were stacked vertically by standing each erect on its end. This arrangement allows a greater number of pieces to make direct contact with the magnet pole-pieces, and the lifting capacity of the magnet is correspondingly increased. With a given magnet, which was able to pick up only 1,000 lbs. of pigs lying flat, it was found that when the pigs were stacked vertically on the floor the load was increased to 2,000 lbs. The increased lifting capacity was obtained with only a slight additional expenditure of labor on the stacking of the pigs.

## COMMERCIAL TENDENCIES IN MALLEABLE CASTINGS PRACTICE.*

By Dr. Richard Moldenke, Watchung, N.J.

AS is well known the production of malleable castings is carried out in America almost entirely with a view to obtaining the "black-heart" variety, while in Europe the white steely fracture is the rule. The latter material may be readily machined and finished with little loss of strength, but the "black-heart" suffers seriously if the skin of the casting is removed. The differences lie primarily in the heat treatment given the two varieties in the percentages of phosphorus and sulphur used, and finally in the service they are put to.

### The Semi-Steel Feature.

The question of strength of malleable castings is not always a serious one, and often something just a little better than cast-iron is wanted. Malleable castings machine up easier than do those in steel. Again, where no labor is to be expended upon the malleable casting, as is practically always the case with the "black-heart" American variety, there is the somewhat natural tendency toward making the least weight do the work, and were this commercial consideration always accompanied with the proper understanding of the characteristics of the material

*Paper read at the 6th Congress of the International Association for Testing Materials, New York, August 1912.

involved, there would be no harm done; but where the consumer forces the manufacturer to take chances that his better judgment would not sanction, then it becomes a serious matter. In the first case, this continual demand for a better grade of material is a good thing for the development of an industry since stricter specifications are made and methods of production are improved; in short, a pound of iron is made to go further in the service of man than it could before.

On the other hand, the following may be said: That in the entire range of the casting industry there is a present tendency toward running up the more striking characteristics of a material to a point of excellence at the expense of others, none the less valuable. For instance, instead of making use of the ordinary malleable casting, as readily made from good irons under standard conditions, a grade of cast-iron made with the plentiful addition of steel to the mixture, and advertised as "semi-steel," is substituted on account of its lower cost. Again, instead of using the steel casting direct, where a high tensile strength is desired, a very-low-total-carbon malleable casting is made to do, because it is cheaper. The result of this shortsighted policy is the production of a series of supposedly high-grade materials which in reality are very unreliable. The principal sufferer is the consumer who does not make any specifications, but gets the bulk of the metal that has to be made to satisfy the one who does. The latter, who may need only a limited quantity, asks for the almost impossible, and the product is probably entirely unsuited for general work.

**American Export Trade.**

Attention is directed to the above tendency in America at this time, because the export of "black-heart" malleable castings is beginning to be a factor in international trade. With a present American production of some 800,000 tons of these castings, and a capacity of over a million tons annually, there is bound to be some investigation on the part of consumers in other countries relative to the merits of the material in question. This in turn compels the producers of those countries to take notice and will naturally affect their practice.

So that the matter may be better understood, a few necessary details of production are given:—In regular malleable melting practice, both in Europe and America, a limited amount of steel scrap is added to improve the material. This effects an initial reduction in the total carbon with a consequent increase in the tensile strength of the finished castings. With the very best of irons, short heats, first-class annealing conditions, and in fact the carrying out of the processes which are calculated to give the best results, it is not possible to get a very high tensile strength without sacrificing some of the shock-resisting properties for which the malleable casting is justly famous. Thus, the ordinary "black-heart" product as tested transversely by means of the 1 in. square test-bar placed on supports 12 ins. apart, should stand a load of 3,000 lbs., applied at the centre, and give a deflection of at least ½ in., and in exceptionally good material the deflection may run even beyond 2½ ins. The tensile strength of such test-bars will, however, not run much over 42,000 lbs. per sq. in. It is quite possible, by a heavy initial reduction in the total

DR. RICHARD MOLDENKE
Secretary, American Foundrymen's Association.

carbon through steel scrap additions, to obtain tensile strengths of above 58,000 lbs. per sq. in., and when extreme care has been exercised in the melting and annealing processes to keep oxidation of the metal down to a minimum, the deflection will still be good. The chances are, however, so very much against this, even in the highest type establishments, that whoever insists upon this high-grade material and bases the calculation of his structures, involving risk of life, thereon, makes a serious mistake. He had much better specify the steel casting in the first place.

As a mere item to show the delicacy of the manufacturing process, there may be mentioned the fact, well known to the producer but perhaps not at all to the consumer, that with composition and manufacturing processes identical up to this point, castings taken from saggers dumped on Monday morning— the one day when the annealing ovens are discharged cold—are much softer, bend and twist better, and are in every way more desirable as malleable castings, than those obtained the other days of the week. Yet the tensile strength of such castings is considerably below those dumped out hot.

**Malleable Casting vs. Cast Steel.**

The malleable casting differs from all others in that any attempt to correct the oxidation of the metal in a heat before pouring so increases the expense that it cannot compete with cast-steel. With the addition of much scrap steel to a charge, with the personal equation of the probable low type of melter, and with the probable variations in the annealing temperatures an attempt to work for very high tensile strengths is not followed by reliable results. The chance of oxidizing the iron in addition to the silicon and manganese is such that a more or less open crystalline structure results, with consequent penetration of further oxygen during the annealing process, weakening the casting. This may be readily seen from the effect of changing to coke irons from the charcoal varieties. Charcoal irons, with their high total carbon and comparative freedom from oxidation as blown in the furnace, when compared with the coke irons, gave the foundryman a chance to obtain good castings in spite of slight unavoidable variations in his practice. In American practice, at least, the change to coke irons has compelled the raising of the silicon specified in pig irons, in order to avoid this chance of initial oxidation as much as possible.

Until we have better melting methods (possibly when the electric furnace has been sufficiently developed along lines of economical production), and until we can obviate or cheaply correct any undue oxidation of the molten metal before it is cast, it would be wise to lay more particular stress upon the development of the malleable casting commercially along lines of greater softness rather than high strength. Where the latter is essential, the steel casting is certain to replace it sooner or later. On the other hand, with the specifications so shaped that the resilience of the material is made prominent for ultimate development, the excellencies of this peculiar product of the casting industry will be brought out and the material kept in its proper sphere of usefulness.

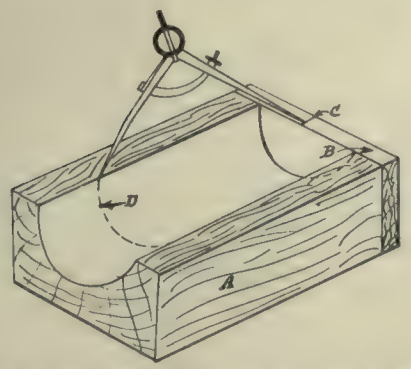
## DRAWING CENTRE LINES ON CORE BOXES.

By H. J. B.

THE usual methods followed by patternmakers, when required to scribe a line across a half round core box, is to plane a piece of wood, square on one side and an edge, lay across the

joint of the box, and mark with a scriber laid against the block. This may be satisfactory if the box is shallow, but if it be of abnormal depth the chances are that it will lead to error. Others again, use a piece of flat steel or an old clock spring. This also varies, and if the box be of any size, it is impossible to draw a straight line by this means.

The following method is not only quicker but absolutely accurate and may be used in a number of ways both in core boxes and patterns:—If (A) be the core




DRAWING CENTRE LINES ON CORE BOXES

box, and (B) a block, or the end of the box, and (C) the centre line of the diameter, place one point of your dividers or trammells anywhere on the line (C) and with the other point scribe the centre line across the box. This gives an absolutely straight line around a core box, providing, of course, that the box is part of a true curve. The method may be used not only in semi-circles but in less or more than a half circle, by merely raising or lowering the point (C) to bring it in the centre of the circle. A second glance will show that the point (C) is the apex of a cone and the scribed line (D) the base, so that no other proof is needed to prove the accuracy of the means employed.

## MOLDING A LARGE PIPE.

By Fides.

SOME time ago it fell to our lot to make a casting like that shown in Fig. 1. It was decided to sweep it.

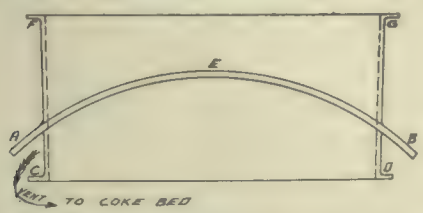



FIG. 1. MOLDING LARGE PIPE CASTING.

This would, of course, have been an easy task, but for the flange A.E.B. with its ever-changing angles. However, after talking the matter over with the draftsman and patternmaker, and on their suggestion, we made up our minds to form the flange A.E.B. with a sweep, because

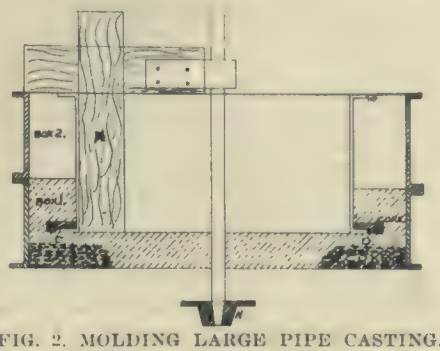



FIG. 2. MOLDING LARGE PIPE CASTING.

other methods thought of were too costly.

To begin with, the spindle seat A, Fig. 2, was bedded level in the floor, central to a box-part which previously had been placed in position. The spindle with its sweep attachment was inserted in spindle seat A, and a coke bed properly laid upon which sand was rammed to form the bottom of flange CD; the top of flange being formed by a core as shown in Fig. 2. After the flange cores were set to gauge, sand was rammed behind them to keep cores in place, then some waste was tucked in the flange cavity to keep the sand from being pressed in. Sand was next rammed up to top of flange A.E.B. and vents made down to

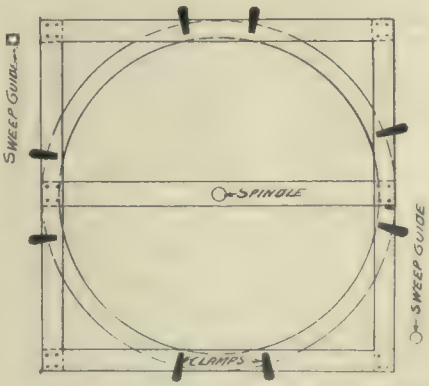



FIG. 3 — MOLDING LARGE PIPE CASTING

coke bed, Fig. 1. A box part, No. 2, which had been placed on box part, No. 1, when sweep was set for height, and afterwards removed, was now replaced. Sweep guide O, Fig. 2, was clamped to flange of box part No. 2, a hole in centre to let spindle through, guiding it to its proper place. Top of flange A.E.B., Fig. 3, was now swept with sweep board O.O. This had pieces 1 and 2 made so that they could be removed to let sweep travel further in box, Fig. 4.

Sweep guide O, sweep board OO, and box part No. 2 were removed and a parting made at A and B, Fig. 5. Our first idea was to cut the flange out at this stage, fill with dry sand, cover with paper, then ram to top of mould and clean out afterwards when finishing. We thought, however, we had better check it off to get a chance to finish it properly. Box part No. 2 was replaced again, and bars bolted to it to carry outside. Our standard round boxes are all drilled to space, so that bars can be bolted to them in case they are needed for any job. Box part No. 2 was again removed, clay washed, joint fixed, dusted with parting sand, box replaced and sand rammed in to top of casting F.G., Fig 5. The sweep was then replaced, and inside of pipe swept, after which the sweep was removed. The anchor plate to lift out inside core was now bedded level with bottom of flange C.D., Fig. 5.

The mould was covered with paper and core rammed up, venting being done and

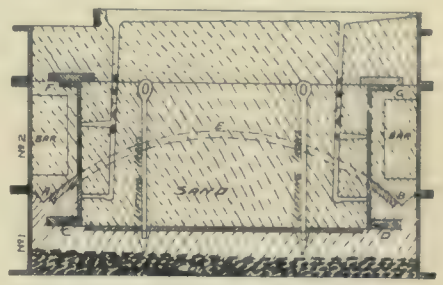



FIG. 5 —MOLDING LARGE PIPE CASTING

rods placed at intervals as the work proceeded. The casting being run from the centre, core gates and runners were placed in position as shown during the course of ramming up. The top of mould was now swept off and centre lifted out, finished, blacked, and put in stove to dry. Sweep X with thickness piece attached, was replaced and outside of mould swept to shape. Box part No. 2 was lifted off finished, blacked and laid aside. The flange A.E.B. was cut out with the trowel, having for guides two pieces of wood to gauge thickness and width of flange; one piece being made a little longer than the other. The waste was now taken out of bottom flange cavity, and the whole finished and blacked. Box part No. 2 was replaced, after which needed finishing touches were given.

A fire pot with coke fire was placed in centre of pipe and mould covered until dry. When mould was thoroughly dried, fire pot was taken out, ashes cleaned

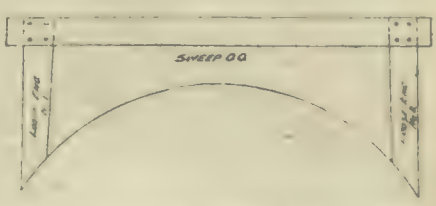



FIG. 4 — MOLDING LARGE PIPE CASTING

away, centre core replaced, top flange F.G. covered with cake cores, cope lifted on, rammed up, runner basin made, mould weighted and cast.

## FIRST PRINCIPLES OF PATTERN-MAKING.*

By T. R. Schofield.

MY present paper is an attempt to outline briefly the fundamental principles on which the work of the patternmaker is based, as modified by the influence of modern engineering and foundry developments.

"That which goes, is right," is not the sentiment which has brought engineering to its present state of efficiency, and it is a sentiment of which the pattern-maker above all others needs to beware, if he thinks he has attained finality in his methods. His very existence, almost, is bound up inseparably with the continued progress ofengineering, and should finality be reached in mechanical engineering, the patternmaker, who is the first to benefit from new designs, would be the first to suffer from continuance on stereotyped designs.

### The Patternmaker's Status.

When engineering made its first great advance, considerations of economy and expedition caused the pattern-maker to take his place as a specialist in this branch, in succession to the old-time millwright. Since then, progress has been very rapid, but still, generally speaking, the same motives which made him a specialist continue to be a controlling factor in deciding on the correct form which his work shall take. The wisdom of his decision is not in question in the case of simple elements, when the pattern is merely a facsimile of the requisite castings, though sometimes such patterns are rather more ornamental than useful, bearing evidence that time has been spent importing a fine finish, which time could have been devoted to gaining a more accurate conception of the purpose for which the pattern was made.

### Pattern-Making Demands High Degree of Intelligence.

In castings of more complex form, however, the design usually admits of several methods of molding, and the advisability of the use or avoidance of cores and drawbacks has to be settled before the pattern is begun; then the decision arrived at assumes a considerable degree of importance to the foundry concerned. Errors of decision in these elemental matters frequently involve the foundry in expenditure of labor which might be avoided. It is of paramount importance, therefore, that the pattern-maker should possess a tolerably exact knowledge of foundry practice and foundry economy, in order that the patterns provided shall involve a minimum of labor to produce the molds and cores.

The first problem which the pattern-maker has to solve, then, is the finding of that particular way, of all the possible ways by which a casting can be made, which shall fulfill the requirements of the foundry to the best advantage. In time past, when patterns were laboriously hand-made and the conveniences now common in up-to-date pattern-shops for rapid production were almost unknown, many ingenious methods were evolved, enabling castings to be obtained from a somewhat meagre pattern preparation. Such castings were not always as true as might be; some of the niceties of design had to be sacrificed, and allowance for machining had to be somewhat generous, to cover inaccuracies. Still, such methods and such castings suited the needs of the time. Contingencies still occur when these makeshift methods are justifiable, as, for instance, the familiar "1 off" job in some of its forms, and the bona fide breakdown. Knowledge of these "cheap" methods form no small part of the pattern-maker's stock-in-trade, but they have tended to become stereotyped into standard methods.

If it is granted that real patterns are essential to bring us nearer the ideal of foundry efficiency, in conjunction with the enormously increased facility with which a pattern can now be made for a correspondingly reduced cost, it is evident there is not now the same justification for adoption of makeshift methods as formerly, and that continued persistence in such methods constitute a serious bar to legitimate foundry progress.

### Everyday Problems.

With these few remarks by way of introduction, I propose now to present the case for a more rational handling of the everyday problems of mutual concern to pattern-maker and molder.

The past ten years have witnessed intensified concentration on the part of engineers, in those spheres which are peculiarly theirs, viz., the efficient utilization of natural scources of power, and the acceleration of production. Among prime movers we now have, for very high powers, the steam turbine and internal combustion engines for both gas, oil and spirit, placed upon a commercial basis. Increased efficiency, higher speeds of rotation, and higher range of temperatures, also the cutting down to a minimum of clearance spaces, have resulted in increased complexity in the castings forming the principal elements of these engines, and have brought into prominence the need for greater precision and uniformity in such castings than has ever obtained hitherto. Leaky joints and much expensive machining and fitting are obviated by combining in a single casting, whenever possible, elements which have hitherto been made separately. These combinations are characteristic of the time, and involve both the foundryman and pattern-maker in greater responsibility for their satisfactory production.

In the sphere of rapid production, the scientific study of the principles underlying the best use of metal-cutting tools, and the introduction in recent years of high-speed steel, have completely revolutionized the design of machine tools. All-gear drivers, quick-change gear boxes and other time-saving, production-increasing features incorporated in their design, have transformed the simplest of them into more powerful, more productive, more nearly automatic machines. Standardized methods of handling castings in quantities for machining, to reduce costs, with the need for interchangeability, have resulted in the application of jigs for all possible purposes, and only serve to emphasize the need which exists for the highest degree of precision in the castings supplied.

(To be continued.)

*From a paper presented at the recent annual convention of the British Foundrymen's Association.

## RADIAL BUFFER.

AN American firm has recently placed on the market a radial buffer, which consists of two castings, one bolted to the engine and the other to the tender; also two other castings and a wedge. Wear in the draw-bar pin holes or pins is taken up by adjusting the wedge in or out, and the draw-bar may be easily uncoupled by withdrawing the wedge. The faces of the two buffing blocks are radial with the centre of the pin holes in the draw-bar, and the floating block between them permits the engine and tender to take any position without changing the distance between the centres of the pins. There is no strain on the draw-bar and pins except when the engine is pulling.

Buffers of this type which have been in service for a considerable time indicate that there is very little wear of the castings, draw-bar pins, and pin-holes. The design is such that there is no necessity for the slack to exceed 1-16 in., thus improving the riding of the locomotive and eliminating the jerking action when drifting at high speed.

It is just as well not to despise the outsider; he often has the best view.

**The John Inglis Co., Strachan Avenue, Toronto,** have acquired a large section of the prison property, immediately adjoining their present plant, and will erect and equip thereon, one of the largest boiler factories on the American continent.

## OIL FUEL ON THE MEXICAN RAILWAY.

THE whole of the Mexican railway locomotives have now been fitted with oil burners, and such difficulties as arose with regard to the drivers and firemen have been completely got over. It appears that when oil was first introduced, every possible difficulty was put in the way by the English and Scotch drivers, most of whom resented the change, and in some cases refused to work the engines with oil. As regards the Mexican drivers there was less trouble. They were shown how the oil fuel should be applied, and how to work the engine under the new conditions, and to the best of their ability followed the instructions without cavil. Subsequently a curious position was developed. There was a difficulty in the oil supply, and many of the engines had to be reconverted and again fired with coal. The Scotsmen in particular, who had been most conspicuous in their obstinate resistance to the use of oil, made louder lamentations over the resumption of coal than any other section of drivers. However, all that is now done with, and the new system works exceedingly well in every respect, and is regarded by the whole staff as an immense improvement on the coal burning method.

With regard to the economies effected by this change of fuel, it may be said that the management do not by any means regard the existing arangements as the end of the advantages to be derived. Further developments in the way of organization are under discussion, and further substantial reductions in the cost of haulage are hoped for in the future.

## OIL FUEL FOR INDUSTRIAL PURPOSES.

THE progress made on the sea by oil has been so rapid that, except for railways, its uses on land seem to have been almost forgotten or overlooked. Of course it has been recognized that in oil centres such as California, it is used in factories to the exclusion of coal, and also in Russia to some extent, although to what extent, the public has no idea, and contents itself with repeating that "the old ways will suit us for years to come. It was a remark made by a late chairman of the London General Omnibus Co. in regard to the use of horses when the Vanguard buses first came on the street, six years ago, but all the horses have gone now, and the prophecy has been falsified.

### The Future Outlook.

All the same, people go on saying coal will be our mainstay for a long while yet, for how can oil which is not at our doors compete with coal which is? Well, it can and it begins to do so. The chief hindrance is that oil in this country for the moment is in the hands of two or three big concerns, who charge whatever prices they like, and are able to do so, owing to the fact that there are not ships enough to bring competiting cargoes. Time—and not a long time even; will alter all that, and what then? As soon as this happens there will be a great increase in the consumption of residual oil for manufacturing purposes.

Mark what has taken place. At the beginning of the 19th century, when all Europe was at last reduced to peace, we through the proximity of our natural resources and fruitfulness in invention captured the first place in the trade of the world, and have held it for nearly a century. The comfort of a fat living checked the inventive faculty, and other nations took pride of place as inventors, being forced by pressure of events to find labor saving appliances, the need of which we did not feel. As they progress commercially, we in turn feel their pressure and the faculty begins to return.

Necessity, that fecund mother, is called upon to bear children, and again responds to the call. Thus in the heart of our coal and iron district is born an oil furnace, bringing into use the burner of old Bunsen, which produces an intensity of heat by a simplicity of method, with an economy of cost, which bids fair to revolutionze many industries. Already, certain manufacturers find that by means of it, they can do the work of thirty men with the aid of one, and already the glass bottle trade by its use begins to return to the country.

### Oil Fuel in General Use.

Already the biscuit princes of the country are installing it in their factories, and a long list of applicants await the delivery of their orders. It is used by steel makers, tube drawers, glass makers, and for china burning, roasting of ores, calcining lime, manufacture of cements, melting, armor plate making, etc., etc. The invention is the work of two men whose labors would read like those of Palissy—a real Samuel Smiles , self-help tale, whose only barrier to advance is want of sufficient capital to finance their orders, and the difficulty of obtaining enough oil at present to supply their customers.

The system is not alone in the world —other countries have been before us and if it were, it would soon have rivals, but what interests us is, that it seems to make a long step in the advance of oil as a fuel on land, and, further, that it must have the effect of distributing industries more widely over the country. No longer must it be necessary for the steelmaker to live in a grimy city, where the foulness of smoke pollutes the freshness of the air, and the sordidness of surroundings debases the moral character. The cleanness of Pittsburg will be the lot of other centres, and haply the Smoke Abatement Society find less opportunity for its labors.

A long way off, all this, but big oaks from little acorns grow, and those who have the keenness of vision to see into the future—the Cowdrays and Furnesses —are already girding up their loins to get a share of the spoils, building argosies to carry oil to these shores.—The foregoing is from the H. S. Stoneham, London, Weekly Statement.

## A FEW NOTES ON GRINDING.

By Cosmopolite.

THE following remarks are prompted by a conversation held with a grinding machine operator during a visit paid by the writer to a large firm of textile machinery manufacturers. This man was running two machines engaged on work of a simple character, but necessitating close adherence to size. Both machines were running with the maximum table travel obtainable. One machine (American) was fitted with a wheel 2 in. wide, the other (British) with a wheel 3 in. wide, the travel per revolution being in each case very nearly the wheel width. The comparative output of the two machines varied approximately as the wheel width. Judging by the way the wider wheel was taking its cut, it seemed possible that a still wider wheel could have been used, if the table travel could have been increased in velocity to harmonize with it, with a corresponding increase in output.

### Speeding-Up Feature.

Now, this is the point on which the writer wishes to insist. Speeding up is the cry of the day. To some extent this has been met in most tools of modern design, and the machines are now probably more than equal to the demands of the now superior cutting tools. In the grinding machine, however, on certain classes of work, although no doubt makers have believed themselves, equally with ordinary machine tool makers, ahead of the tools (in this case grinding wheels) obtainable, they are still behind. What is the reason for this?

The output of the grinding machine depends almost wholly upon the speed of table travel. If this is but 6 ft. per minute, neither wheel speed, work speed, nor width of wheel can be modified to increase the output.

What are the difficulties in the way of using a faster table travel? From a somewhat careful examination of vari-

ous grinding machines we would assert that beyond doubt the difficulties are wholly constructional. With existing reversing mechanisms for the table travel, the shock is so severe as to occasion the periodic breakdown of the clutches. Surely some form of shock absorber is possible of incorporation. The British machine examined had a friction slipping device which partially overcame the trouble; but even in the event of this difficulty being overcome, it might be argued that still another source of trouble would be the extra weight of the wider wheel needed to cope with a faster table travel.

In reply to this, the writer would say that if the parts carrying the wheel were enlarged to the size they are on a larger machine, and other parts of the machine strengthened to correspond, this difficulty would be met. There is, of course, always the factor of the balance of the wheel to take into account, but this would be met exactly as it is on larger machines. In fact, on all machines, no matter the size, it is advisable to true up the wheel when it is running at the speed at which it is to run when at work.

It is, of course, advisable to roughly true the wheel at a lower speed than the working speed, for the sake of the life of the diamond. The reason for truing up at running speed is as follows. No wheel can be guaranteed to be thoroughly homogeneous in structure. Hence, if turned true for one speed, an increase in speed may destroy the running balance again. For this reason, in dealing with work having more than one diameter, it is better to avoid changing speed for the different steps, although by doing so, frequently a more efficient cut is attainable.

**Table Travel and Wheel Width.**

Again, it may be argued that an increase in table travel and wheel width will result in a greater tendency to spring the work; but the steadies will take care of this. In modern grinding practice, it is becoming more and more a golden rule: "Get as many steadies on as the work will permit."

Let us, however, take the case to its extreme. Imagine a wheel as wide on face as the length of the work, and let this wheel be trued up so that it would produce work true and parallel by the cross feed only. The amount of metal being removed per unit of length is remarkably small; the depth of the cut being probably but one or two thousandths, under normal grinding conditioss. Is it likely that the spring of the work or machine would be inordinate? At the wheel the pressure is exceedingly small on account of the cut being shared amongst so many cutting edges. Imagine the number of cutting edges passing the work in, say, a minute. The pressure on the work cannot be any greater than that on the wheel, any more that the pressure on the teeth of two intermeshing gears can be different. No, it is not pressure, but vibration that counts, and absorption of vibration can be secured by attention to the arrangement of the steadies, and mass in both these and the machine parts.

**Pressure Feature.**

At any moment the number of cutting edges passing or in contact with the work at a given instant, determines the total pressure on the wheel. This pressure varies directly as the width of the wheel and can be resisted by increases in the strength of parts. As regards the work, the pressure per unit of length is a constant, capable of being dealt with by arrangement of steadies. In any case the steadies are necessary as absorbers of vibration, as has been already pointed out. With a given wheel speed the width of the wheel has no influence whatever on the pressure per unit of work length, as the number of cutting edges in contact per unit is invariable, Thus, the wheel width and table travel may be anything that the detail construction of the machine will permit.

**Conclusions.**

To sum up:—Although the advance in the art of grinding has been exceedingly great, there is no reason to suppose that finality has been reached. Is many cases the lathe has received a powerful competitor, even as a roughing-out machine, in the grinding machine. With greater attention to points, such as those cited, who can say that the lathe will not for many purposes be entirely ousted? The writer has endeavored to show where the weakness lies, and that it does not, as many opine, lie in inherent incapabilities of wheel or work. Perhaps grinding machine manufacturers will take these few hints to heart and eventually produce a machine capable of filling a still more important position than it now holds in the scheme of intense production of the present day.—Page's Weekly.

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**Insufficient Illumination.**—It is estimated that 25 per cent. of industrial accidents are due to insufficient illumination. This is particularly true where workmen pass from daylight to places lighted artificially. The artificial light may be sufficient for those accustomed to it, but the eye does not respond immediately to the change in light when passing from a very bright illumination to a place lighted at low intensity. It is therefore, important that lamps be placed along walkways and thoroughfares rather than distributed uniformly over the whole floor.

# Trade Gossip

**Mr. E. G. Buckwell,** secretary and manager of sales for the Cleveland Twist Drill Co., sailed on the Carmania on October 5 for a business trip abroad of two months' duration.

**The Smart-Turner Machine Co., Ltd., Hamilton, Ont.,** have recently secured the following orders:—Mr. E. D. Smith, Winona, duplex pump; Prince Arthur Hotel, automatic feed pump; Mr. S. I. Strong, Napanee, Ont., rotary pump; Great Lakes Dredging Co., duplex pump; J. P. Mullarky, Sydenham, Ont., duplex pump; New Brunswick Pulp & Paper Co., Millerton, N.B., duplex pump; Deloro Mining & Reduction Co., Deloro, Ont., centrifugal pump; Mr. James Stark, Paisley, Ont., centrifugal pump.

**The Hill-Leonard Engineering & Construction Co., Toronto, Ont.,** will handle general construction work through that province, especially railway supplies. Its equipment consists of the type of machinery necessary to this line of work and the company will be in the market from time to time for additional supplies, including dump cars, small locomotives, shovels, drills and small tools, such as scrapers, etc.

**Messrs. Herbert Morris Ltd., a Canadian company** recently incorporated, have established headquarters in Toronto, at 79 Peter Street. They will represent, in Canada, the well known English house, Herbert Morris & Bastert, Ltd., Empress Works, Loughborough, makers of Lifting and Shifting Machinery. Agencies will be maintained in Montreal, Winnipeg and Vancouver and a stock of Chain Blocks and Hand Cranes will be carried at these places and in Toronto. A stock of heavier lifting machinery, overhead travelling and swing cranes, etc., is carried at the works, and quick delivery will be made on Canadian orders. Malcolm R. Meldrum M.E. is general manager of the new company.

**The Canadian-Cleveland Drill Co., Ltd., Toronto,** who handle for all of Canada the air tools manufactured by the Cleveland Pneumatic Tool Co., of Cleveland, Ohio, have moved from their old quarters, 24 Adelaide Street West, to 80 Duchess Street. They have added greatly to the supply of tools and repair parts carried in stock and have also installed an 8 x 8 air compressor, electrically driven, for demonstrating tools to visitors and also for use in their repair shop. This move on the part of the Canadian-Cleveland Drill Co. puts them in a position to have a large stock of tools on hand for delivery at all times, also repair parts, and in the event of repairs being required to their tools, these also can be attended to immediately at the shop in Toronto.

ESTABLISHED 1851.

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COR. STRACHAN and WELLINGTON AVENUES.

TORONTO, Sept. 27, 1902.

FROM

JOHN B. SMITH & SONS

MANUFACTURERS OF

LUMBER, LATH, SHINGLES, DOORS, SASH, BLINDS, PACKING CASES, ETC.

The General Fire Equipment Co.,

City.

Dear Sirs,—

We have had an experience with a fire a few nights ago which we think you should know about. In one of our lumber dry-kilns we had an iron shaft which was used to convey power into a machine shop beyond the dry-kiln. A coupling on the shaft became detached and the friction caused the iron to become red hot and set fire to the premises. This shaft is situated in the pit where our hot air pipes are, and although our large fan was blowing the hot air and the flames right into our kiln-dried lumber, your sprinkler heads opened and put out the fire completely. When the firemen arrived, the fire was completely extinguished. We think this speaks volumes for your sprinkler system and we hope that you may be able to let other manufacturing firms know about them and particularly about this fire.

Yours truly,

John B. Smith & Sons

# "When the Firemen Arrived the Fire Was Out!"

This letter was received just ten years before this advertisement was written. The system of fire protection that saved the situation so promptly then is just as efficient to-day. It stands on guard here and in many another plant, ready to drown the stealthiest of fires.

Your plant—your machinery—your peace of mind should be protected by the same absolutely certain system—

## Manufacturers' Automatic Sprinklers

*Send for estimate on equipping your plant.*

**The General Fire Equipment Co., Ltd., 72 Queen Street East, Toronto**

# STEEL CASTINGS

Acid Open Hearth Steel for **Locomotive and Machinery Castings.**

Stock Process Steel for **Automobile and Light Castings of all descriptions.**

## Our plant will be in operation early in October.

**(Annual Capacity, 12,000 tons.)**

***Let us figure on your requirements.***

**The Dominion Steel Castings Company, Limited**

**HAMILTON, ONTARIO**

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**New Westminster, B.C.**—An agreement has been made between the city and the Heaps Engineering Company, whereby said company agrees to erect a machine shop and to employ not less than 100 men. The city's obligation is to go before the ratepayers soon for ratification.

**Walkerton, Ont.**—The Dominion Stamping Co., Ltd., has erected a large foundry in this city and is installing machinery of the most improved type. The paid-up capital of the company is placed at $250,000. Within 30 days it expects to have in operation one of the largest plants of its kind in the Dominion.

**Portage la Prairie, Man.**—One of the two important industries about to be established here is the Western Radiator Company. The promotors of the aforesaid company are well-known Winnipeg men. As yet, particulars are not made public

**Regina, Sask.**—The Kissel Motor Car Company, of Hartford, Wis., is about to locate here and in fact it is proposed to make this city its headquarters. The trucks made will be of the 1,500 pound type and of various powers: 30, 50 and 60 h.p.

**Butte, B.C.**—According to a report made by Patrick Clark, the Spokane mining capitalist, this is to be made the site for a plant which will be installed for the treating of copper ores.

**Irondale, B.C.**—Work will soon be commenced in the steel foundry of the Western Steel Corporation. Mr. Moore, the president, assures the people here that the plant is about ready and that men would be employed at once

**Pembroke, Ont.** — The Canadian Northern Railway, having received the assurance of a bonus of $25,000, exemption from taxation, and free water, has agreed to make this a divisional point at which machine shops will be erected

**Moose Jaw, Sask.**—The Traction Plow Company proposes to erect a foundry for the manufacture of plows under certain conditions: An agreement has been made between the said company and the city whereby the city will sell, for the sum of $20,000, lots 1 to 20, block 28, for site for aforesaid foundry, or plant, and in return for same, the company agrees to invest between $150,000 and $200,000 in said industry and to employ at least 35 hands.

**Galt, Ont.**—The Hare Engineering Company will shortly commence operations here in the establishment of a plant to cost at least $100,000. The company has $400,000 subscribed capital, and among the shareholders are W D. Sheldon, J. Fergus MacGregor and Allen Hills, all local men.

**Prince Albert, B.C.**—Among the four industries that are to be established and which are seeking bonuses, is a foundry which will have a capacity of 14 tons per day.

**Yarmouth, N.S.**—The worst fire that Yarmouth has had for some time took place recently, when Sanders' Machine shop on Water St. was almost destroyed. The fire was first discovered in the attic. The attic room was full of patterns made principally of pine and very dry. The building, owned by Edward Allen, was badly damaged and there was no insurance. Mr Sanders had $2,500 insurance in F. K. Spinney's agency on the stock and the machinery, but this will not compensate for the loss of valuable patterns of many years' accumulation.

### MUNICIPAL.

**Tilbury, Ont.**—The by-law to grant a loan of $5,000 to assist the Imperial Rubber Company in the establishing of a factory, received the endorsement of the ratepayers

**Wilkie, Sask.**—The following by-laws were recently passed:—to raise $28,000 for waterworks system; $2,250 for extension of electric lighting system; $2,250 re fire protection; and $8,000 for skating rink.

**Kerrobert, Sask.**—The burgesses have passed a by-law to raise $82,000 to cover cost of the installation of a waterworks system.

**Kindersley, Sask.**—The burgesses recently endorsed the two by-laws which provided for the raising of $1,000 and $3,000 for hospital and town hall respectively.

**Nelson, B.C.**—The qualified voters defeated the by-law to raise $75,000 for the acquiring of the Nelson Coke and Gas Company.

**Port Colborne, Ont.**—The council recently met and authorized the Reeve to issue debentures to the amount of $20,000 for the extension of the waterworks.

**Raymore, Sask.**—A by-law was recently carried whereby $5,500 will be raised by debentures to build a town hall.

**Oshawa, Ont.**—The by-law to raise $32,000 for the erection of a new public school on King Street was passed by the council at a recent meeting

**Kindersley, Sask.**—The ratepayers endorsed the by-law to raise $90,000 for waterworks and an electric light system.

**Port Colborne, Ont.**—The town council has passed a by-law providing for the issue of debentures to the extent of $20,000 for extensions and improvement of waterworks.

**Macleod, Alta.**—The following by-laws received the assent of the ratepayers:—to raise $50,000 for a new filtration plant, $50,000 for a sewerage disposal plant; and to raise $36,000 for a new trunk sewer.

**Aurora, Ont.**—The ratepayers voted in favor of the by-law to raise $15,000 as a loan to the Collie-Cockerill Company, manufacturers of office furniture.

**Niagara Falls, Ont.**—The waterworks pumping by-law calling for the raising of $7,000 was recently endorsed by the ratepayers.

**Port Alberni, B.C.**—The by-law to raise $100,000 for a civic waterworks system received the endorsement of the burgesses recently.

**Duncan, B.C.**—The ratepayers recently carried the following money by-laws:—to raise $25,000 for cost of waterworks system; $15,000 for a new school; and to raise $65,000 for electric light and power purposes.

**Macleod, Alta.**—The following by-laws have been passed by the ratepayers:—to provide for the raising of $81,000 re filtration plant; $50,000 sewerage; and $36,000 for sewerage extensions.

**Tofield, Alta.**—The following by-laws were recently endorsed by the ratepayers:—to raise $25,000 for waterworks; $43,000 distribution of gas; $4,200 for hospital; and to raise $1,000 for drainage.

**North Vancouver, B. C.**—A by-law to raise $50,000 to purchase additional shares in the Burrard Inlet Tunnel and Bridge Company will shortly be placed before the ratepayers

**Kingsville, N.S.**—The ratepayers will have the opportunity to sanction the raising of $10,000 to meet the present indebtedness of the corporation some time in the near future.

**Sarnia, Ont.**—The Town Council has decided to submit a by-law to authorize the raising of a new intake at Point Edward.

### ELECTRICAL.

**Lethbridge, Alta.**—The first street cars to be put into operation by the municipality were started a short time ago when free rides were given to the citizens. The electric line is 10.5 miles in length.

**Saskatoon, Sask.**—The Automatic Electric company of Chicago has signed a contract with the provincial government of Saskatchewan for the installation of a new automatic telephone plant in Regina. The government was largely influenced by the successful operation of a similar plant in Saskatoon, installed by the company. The present capacity of the Saskatoon plant is 2,000

**Cobalt, Ont.**—The British Canadian Power Co. has been absorbed by the Northern Ontario Light and Power Co. The former concern operated soley in Cobalt, generating electric power at the Matabitchouan, and using part of it at their station on the Cobalt Lake for compressed air purposes at mines. They also supplied electric power. The present amalgamation marks the close of a long series of amalgamations, whereby the present situation in the north is being considerably improved. The Northern Ontario Light and Power Co now supplies power all over the north, having franchises in Sturgeon Falls, Cobalt, Haileybury, New Liskeard, Porcupine and Cochrane.

**Willow City, B.C.**—Telephone lines have just been completed into the town, and the Grand Trunk Pacific right of way camps are located at the mouth of the Willow river. It is the terminus of a spur of the Pacific and Hudson Bay railway from their main line through the Salmon River country to connect with the Grand Trunk Pacific. There are several other lines projected to reach the city. The townsite is being placed on sale by the Pacific Bond and Land Corporation, of Vancouver

**Winnipeg, Man.**—The Winnipeg Electric Street Railway has concluded negotiations for the purchase of its right-of-way as far as Stony Mountain. The grade is to be completed by the winter season.

**Kamloops, B.C.**—The burgesses recently endorsed the following by-laws:—To raise $250,000 for Hydro Electric purposes; and to raise $65,000 for electric light distribution. This means bringing unlimited power from Barrier River, and a basis for inducement to industries here

**Caledonia, Ont.**—Early in October it is expected that the town will be in readiness for the turning on of Hydro-Electric power. The town will then be lighted from the Grand Trunk Railway station to the river by the system.

**Thornbury, Ont.**—The by-law recently submitted to the ratepayers, providing for the raising of money for electric power, was carried by the ratepayers.

**Humboldt, Sask.**—The burgesses carried the by-law calling for the raising of $30,000 for electric light service

### GENERAL MANUFACTURING.

**Stratford, Ont.**—It is reported that the McLeod Milling Co. will increase their stock to $200,000. and make extensive enlargements to the plant. This will make the mill one of the largest in this part of the country.

**Oshawa, Ont.**—The McLaughlin Carriage Co of Oshawa, have taken out a permit to build an addition to their factory, two storeys high, 250 ft. by 60 ft. Their present manufacturing facilities are inadequate to meet the increasing demand for McLaughlin motors. This large addition to an already enormous factory is an excellent indication of the prosperity of McLaughlin products.


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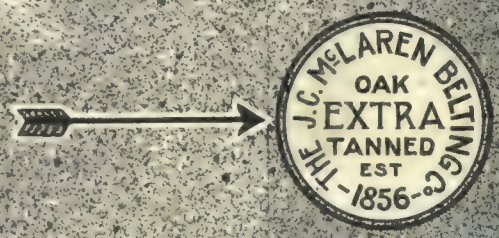


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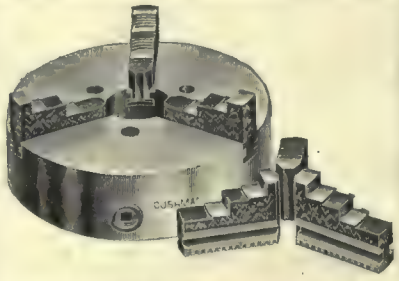

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**Wainwright, Alta.**—Wainwright's new flour mill, which is being erected by C E. Bird & Co., is expected to be ready for operation in ample time for the needs of the district, following threshing.

**Owen Sound, Ont.**—Contractor W. J. Campbell, Owen Sound, has received the contract for building the factory of the Superior Match Company Mr. James C. Grier has the subcontract for the foundation and the brick work which has already been begun. The whole project will be rushed ahead so that manufacturing may be begun during the month of November. The factory buildings will be of brick and steel throughout, the roof to be carried on sixty foot steel trusses, with no intermediate supports. The main building will be one hundred and eighty feet in length. While match factories are usually clean and well ventilated, it is planned to have the Superior factory unusually well equipped with sanitary appliances and fittings designed to assure the health and comfort of the employees. Rest and lunch rooms will be provided for the men and girls, separately Several directors of the match company were in Owen Sound recently, inspecting the building site and arranging details with General Manager McArthur. Mr. Gerard Muntz, of Toronto, president of the Share and Debenture Company, which has underwritten the match company stock states that no expense will be spared in making this the finest match factory on the American continent.

**Canora, Sask.**—A company, known as the Canadian-American Egg Company, Ltd., have secured the sole rights to operate the secret process for preserving eggs in Canada and they will proceed at once to the erection of a factory of large dimensions. It will be 100 by 125 feet, two storeys high, and will contain all the latest machinery

**Elmira, Ont.**—Fire recently destroyed the flour mill owned by Mr. G. Ratz. The mill which was built in 1866 has been operated by the one family since that date. The power house was saved and therefore the electric lighting plant. The loss will be about $12,000 with $7,000 insurance carried

**Sarnia, Ont.**—The Anker-Holth Manufacturing Company have decided to erect a branch factory here for the manufacture of cream separators, and other mechanical appliances. The company is well known in Chicago and its location here means an asset to the town.

**Parry Sound, Ont.**—The large veneer factory, mills, drying kiln and drying sheds of the Niagara Veneer and Basket Company was recently destroyed by fire. The loss is estimated at $100,000 with insurance to the extent of $25,000. The fire occurred whilst the men were at dinner, thus the flames had made considerable headway before being noticed

**Montreal, Que.**—Robert H. Reid, Vice-President of the Labrador Pulp and Paper Company has announced the increase in the capitalization of the company from $3,000,000 to $15,000,000. This large increase in capital will be responded to by extension of operations by the building of two large mills, one at Hamilton Inlet and the other at Sandwich Bay.

### PLANING AND SAW MILLS.

**Moose Jaw, Sask.**—The Rogers Lumber Yards Company of this place with a capitalization of $2,000,000, has been chartered to carry on a general lumbering business throughout the Dominion The directors are: Authur George, John Rogers, Peter Harvey, Alfred W. Jones, and Johnson Siehall, of Moose Jaw.

**New Westminster, B.C.**—A new industry has just been inaugurated by the Powell River Pulp and Lumber Company near here. The company, during the present season, has stripped its hemlock logs of their bark for use in tanneries or else for tannery extract.

**Vancouver, B C.**—Fire recently destroyed the frame, sash and door factory of Hatch Brothers at Cedar St. The total loss of the fire is estimated at $45,000, which is practically all covered by insurance. The cause of the fire is unknown.

**Sudbury, Ont.**—A deal has just been culminated within the past week whereby thirty acres of land on the lake shore, just outside the town limits of Haileybury, has been sold to the Lake Expanse Lumber Company, which will erect one of the largest saw mills in the north country. The property embodies part of the C. C Farr property and borders on the lake shore at Moore's cove. The new company is composed of Ottawa, Renfrew and Haileybury residents, prominent among whom are Councillor O. M. Hennessey and H. S. Hennessey of Haileybury The new company has purchased a timber limit of about 100 square miles in the Province of Quebec. From which it will take the lumber to Lake Temiskaming and then float it over to the new plant which will be erected next spring.

**Leamington, Ont.**—The sash and door plant of the Ludlam-Ainslie Lumber Company here

was recently destroyed by fire which is said to have started in the boiler room. The plant has been taxed to its capacity this season and its loss will be felt by the builders as well as men employed there.

**Yorkton, Sask.**—Plans are being prepared for the erection of a modern sash and door factory and planing mill by the promotors, the Messrs Logan and Black. The building will be equipped with the best and most up-to-date machinery and promises to fill a much felt need in the vicinity.

**Runnymede, Ont.**—James Staple's planing mill here was recently gutted by fire. The loss is $2,000, with $700 insurance. The origin of the blaze is under investigation.

**Uxbridge, Ont.** — Robert Reynolds, who recently purchased the Harman foundry, is excavating for a new planing factory on the north side of the foundry. The old shop just to the north of the main building has been removed and the new one will stand in its stead. It will be 40x60 feet, cement foundation and floor, one storey, and is to be equipped with modern machinery.

**Toronto, Ont.**—Defective fire alarms resulted in the large woodworking factory on Vanauley Street being completely destroyed. The fire which did damage to the extent of $10,000 started in the show case factory of H L. Woods.

### BUILDING NOTES.

**Toronto, Ont.**—Work on the new million dollar technical school is to be begun this fall. Principal McKay had a huge roll of plans of the school to use in explaining certain projected changes, but the industrial advising committee failed to have a quorum A letter has been received from the architects Ross and McFarlane, Toronto, in which they say: "We are now preparing working drawings and specifications as to alternative plans for brick and stone for the exterior. We expect to have everything ready to begin work before the close of the year

**Duck Lake, Sask.**—Duck Lake's new $7,000 town hall has been started. The building will be 30x70 ft., two storeys high with a basement and will be heated by a furnace. The building is to be brick veneer but owing to the lateness of the season the brick work will probably not be done until next spring. The rest of the work will be done this fall and it is expected that the building will be ready for occupying in two months. The construction will be done under the supervision of the Council by day labor Mayor Fawcett will supervise the cement and carpenter work. Councillor R. T. Shepherd is chairman of the hall committee. The site of the hall is on the corner of Victoria and Second Avenue.

**Toronto, Ont.**—The owners of the Queen's Hotel are considering the erection of an addition to their hostelry, that will involve an expenditure of $200,000, according to Mr Henry Winnett, one of the proprietors. The addition will be erected to the east of the present building. The ground is at present used as a garden for the guests and has a frontage of 100 feet. Plans for the proposed structure call for 75 rooms and baths, and in the interior the corridors will be continued throughout the entire building, all the rooms and furnishings being similar to those now installed in the hotel. The exterior will also be of the same design, and will, when finished, present an unbroken surface on Front street.

**Saskatoon, Sask.**—The Saskatoon Sanitary Laundry Co., Ltd., has been taken over by the Co-operative Laundry Co., Ltd. A new $100,000 plant is to be erected, and every device known to the modern laundry installed. It is stated that the new plant will be the most modern in Canada, and, as the men at the head of the affair come from the States, there will also be devices used which so far have never been tried out on this side of the line. In addition to the premises of the present laundry, which are located on Avenue C, between 22nd and 23rd streets, the new company has purchased 50 feet adjoining Avenue C, on which property it will erect the new laundry, utilizing the present building for dry cleaning and shoe repairing work, which will be an important department in the new business

**Vancouver, B.C.**—The C. P. R. will begin construction in the near future, of a two-storey, brick and concrete building at the False Creek end of Drake street. The structure will cost in the neighborhood of $75,000 and will be used as the storehouse for the dining car department. It will be fifty feet wide and two hundred feet long and so divided that there will be ample storage room for the various supplies which are necessary for stocking up the dining cars.

**Fort William, Ont.**—It has been made public that the contract for the erection of the buildings for the National Tube company's plant in this city has been promised to M. H Braden, a local contractor. The plans and

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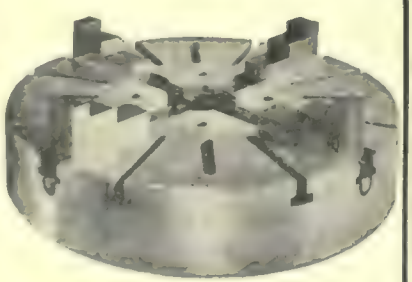

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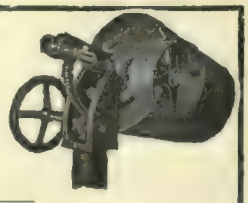

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## INCREASING RAILWAY RETURNS.

CURRENT reports of the revival of railway traffic are verified by the official returns for the month of July compiled by the Bureau of Railway Economics from reports to the Interstate Commerce Commission covering over 220,000 miles; about 90 per cent of the steam railway mileage of the country.

The increases in net revenue were not, however, universal. For the Eastern group of railways the increase over July, 1911, was 10.9 per cent., or $2.01 per mile of line per day; for the Western group 16.4 per cent., or $1.29 per mile of line per day. The net revenue of the Southern group decreased 5.5 per cent., or 41 cents per mile of line per day.

Taking the average per mile of line for the month for the country as a whole, total operating revenues increased $89 or 8.7 per cent.; operating expenses increased $53 or 7.6 per cent.; while net operating revenue increased $35.89 or 11 per cent. Taxes amounted to $45 per mile of line, an increase of 8.5 per cent.

The aggregate of all net operating revenue for the month was $80,197,743, an aggregate increase of $9,037,016. This net operating revenue per mile of line for the seven months of the calendar year continues less than for the corresponding seven months of 1911. Net operating revenue is the amount available for taxes, rentals, interest on bonds, appropriations for betterments and dividends.

## RECENT PATENTS.

BELOW will be found a list of all patents recently issued in Canada relating to mechanical engineering and iron and steel foundry practice, furnished by Fetherstonhaugh & Smart, Castle Bldg., Ottawa, Canada.

142,497.—Van D. Morrison & A. H. Schlaegel, Indianapolis, Ind. Locks for stuffing boxes. Van D. Morrison & A. H Schlaegel. G. O. Filton.

124,507.—Jno. M. Cameron, Johnston City, Ten. Automatic pullation lubricators. Thos. Hemmell.

142,516.—Jno. H. McCloy & A. M. Brown, Pittsburg, Pa. Stay bolt construction for steam boilers.

142,520.—O. E. Appel, Bushton, Kan. Suction priming cups.

142,525.—F. Geo. Browne, Malvern, near Melbourne, Victoria, Australia. Machines for cleaning the hulls of ships below water line.

142,571.—L. R. O'Neill, Montclair, N. J. Governors.

142,614.—Chas. A. Milne, Detroit, Mich. Air compressors. Chas. A. Milne, D McCracken and B. Graham.

142,625.—Jno. Slingsky and Jno. W. Slingsky, Los Angeles, Cal. Saw filing devices.

142,627.—L. C. Adams, Penetanguishere, Ont. Make and brake sparking devices for engines.

142,656.—H. B. Karlin, Jarla, Stockholm, Sweden. Regulating means for steam engines.

142,657.—Jno. Kellington, New Westminster, B.C. Fluid pressure engines.

142,667.—Hon. C. A. Parson, Newcastle-on-Tyne, England Marine turbine installations.

142,671.—I. T. Price, Holten, Kan. Oscillating engines.

142,672.—Chas. B. Rednip, Canton, Cardiff. Co. of Glamorgan, Wales. Fluid pressure engines.

142,679. — Wm. Jos. Still, London, Eng. Internal combustion engines.

142,689. — A. Winner, Dorchester, Mass. Combustion engines.

142,707. — Ed. H. Belden, Pittsburg, Pa. Internal combustion engines. Belden Eng. Co.

142,708.—Geo. H. Ridlon, South Whitley, Ind. Nut tapping machines. Grip Nut Co.

142,721.—L. K. Siverstone, Carrington, N. Dakota. Compound rotary steam engines. F. W. Socile and H. E. Soule.

142,722.—Wm. R.. Sanders beharminn

142,722. — Wm. R. Sanders, Sunset, Tex. Steam engines. Wm. R. Sanders and Jno. Harvey.

142,728.—W. A. Scott, Tacoma, Wash. H. P. Grant, Se.

142,733. — Chas. A. Anderson, Newport, Ken. Pipe threading and reaming devices.

142,739. — B. Borden, Toronto, Ont. Pipe and bolt threading tools.

142,741.—R. I. Call, Wetaskiwin, Alta. Rotary engines.

142,752.—A. E. Hall, Merion, Station, Pa. Internal combustion engines.

142,774.—W. S. Thomson, New York, N.Y. Internal combustion engines.

142,779.—Thos. Veitch, Dumont, N.J. Internal combustion engines.

142,781. — Jno. Thos. Wallace, St. Louis, Mo. Rivet and bolt making machine.

142,789.—C. E. Mead, Dayton, Ohio. Gas engines.

142,840. — W. Ruppert, Porz-on-the-Rhine, Germany. Lathe accessories.

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### RECENT INCORPORATIONS.

**Toronto Electric Motor Car Co., Ltd., Toronto**; capital, $300,000; provisional directors, James A. Riordan, Albert E. Adams, Edward C. Coleman and others.

**The Canadian Steel Package Co., Ltd., Morrisburg, Ont.**; capital, $500,000; to manufacture iron, steel or galvanized barrels, boxes, etc.; by W. H. McGannon, F. H. Broder, W. W. Flynn and others.

**Thor Iron Works, Ltd., Toronto**; capital, $100,000; provisional directors.


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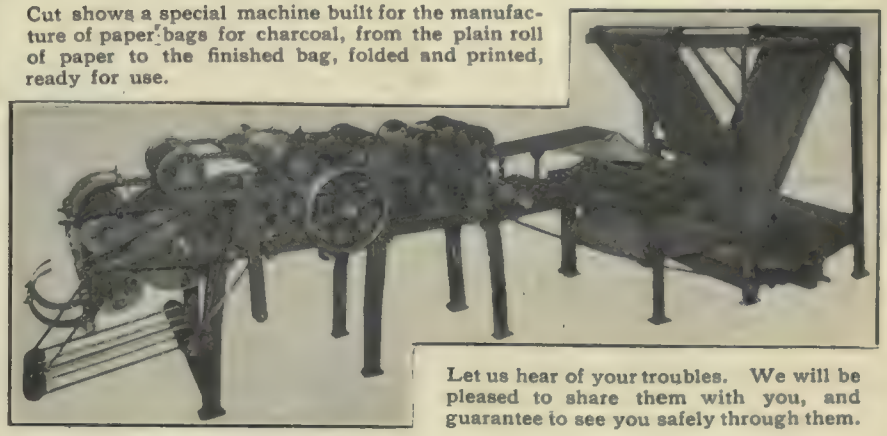

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**Electrical Utilities Co., Ltd., Toronto**; capital, $50,000; provisional directors, James Fowler, John A. Macdonald and Reginald F. Smith.

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# Longue Pointe Plant of the Canadian Steel Foundries, Ltd.

By L. G. Dennison, B.A., B.Sc.*

*For several years the demand for steel castings throughout the Dominion of Canada has been greatly in excess of the productive capacities of the various established steel foundry plants, in spite of their most strenuous efforts to cope with the situation. With a view to fully satisfying this present particular requirement and at the same time provide for, at least near future needs ,as further development takes place, the Canadian Steel Foundries, Ltd., decided to erect a thoroughly modern and commodious additional plant at Montreal. A few months ago, production was commenced, and as soon as everything is in full swing, 3,000 tons per month will be turned out.*

THE attention of the people of Canada has been called very frequently to the wonderful development of the iron and steel industry in general, but little has been heard of the progress in the making of steel castings in Canada. While this branch of the steel industry is not as large as some of the other steel making units, such as rail mills, it is none the less important. It is interesting to note that the new Longue Pointe plant of the Canadian Steel Foundries Limited, is, in design, layout, construction and equipment, the last word in up-to-date steel foundry construction, and one which takes front rank amongst the foundries of America.

The Canadian Steel Foundries, Ltd., was organized in 1910 for the purpose of taking over the Montreal Steel Works, Ltd., having an existing plant at Point St. Charles, Montreal, and a plant under construction at Longue Pointe, Montreal —also the Ontario Iron and Steel Co., Ltd., with steel and rolling mills at Welland, Ont. The plant at Longue Pointe started operation on July 4th, of this year, and with its capacity of 3,000 tons per month, brings the combined monthly capacity of the three plants to approximately 5,000 tons, thus doubling the entire steel casting capacity of Canada.

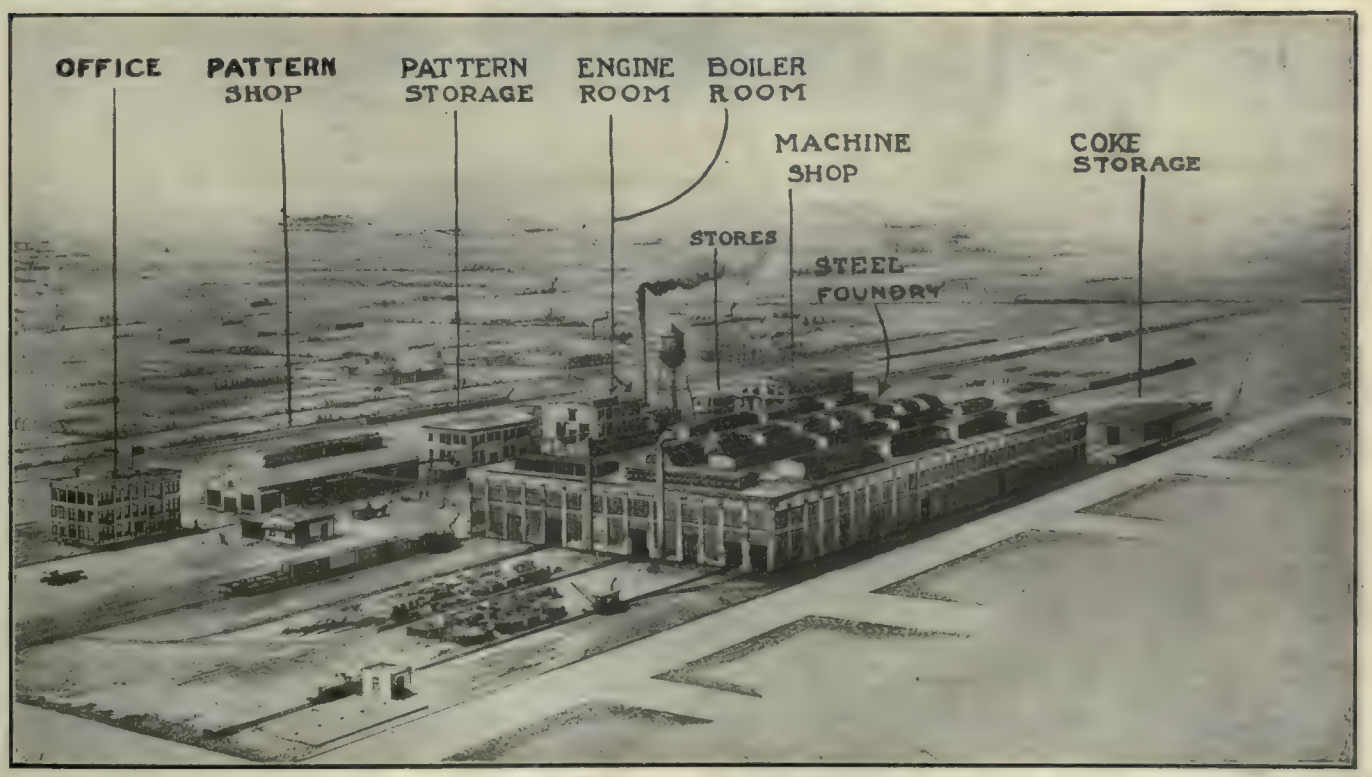
The demand for steel castings is ever increasing, the largest users being the railways, locomotive and car builders, bridge, dredge and ship-building companies, and machine tool makers. The Longue Pointe plant has been equipped with special annealing ovens, gear molding machines, roll turning lathes and straightening presses, to take care of the requirements of these different concerns. The firm manufactures at Longue Pointe locomotive frames, wheel centres, miscellaneous engine castings, double body and truck bolsters, high carbon rolls, gears, dredge buckets and a general run of steel castings. In addition to the regular open hearth products, castings of manganese and vanadium steel are an important branch of the firm's business. A specialty is made of high grade manganese steel switches, frogs, mates, diamonds and all intersection parts for steam and electric railroads, as well as manganese castings for dredge work, mining and crushing machinery. The vanadium steel produced is used largely in engine frames and smaller miscellaneous castings where great strength is required.

### The Buildings.

The plant is situated in Longue Pointe, about a mile east of Montreal City limit. The property extends to the river and the buildings are about a quarter of a mile therefrom.

The latter all have structural steel frames, concrete foundations, brick curtain walls and steel window sashes. The main buildings have concrete roofs, with the exception of the power house and machine shop, which have terra cotta roofs. T. Pringle & Son, Ltd., of Montreal, were the architects and engineers.

*Associate Editor, Montreal.




BIRD'S EYE VIEW OF THE PLANT.

They prepared the plans and specifications and supervised the construction. The machine shop and power house were built with both gas and air chambers, the former being bricked up. Should the supply of oil be cut off, or the price

INTERIOR VIEW OF PATTERN SHOP.

EXTERIOR VIEW OF PATTERN SHOP.

erected by the Bishop Construction Company and the balance of the plant by C. E. Deakin. The Dominion Bridge Company supplied and erected the structural steel work, and H. C. Hitch & Co. built the concrete foundations and did the grading for the main foundry building.

### The Foundry.

The foundry measures 436 feet long from north to south, and is 264 feet wide. It is divided into five aisles, one extending across the south end and four running longitudinally from this aisle to the north end of the building. Stock is loaded into charging boxes in the yard and brought into the foundry to the west aisle which is served by a 15-ton Dominion Bridge travelling crane. Stock is charged into furnaces by a Morgan 5-ton, 4 motor, high type charging machine, seen in the view of the charging platform. There are two 25-ton acid furnaces using oil fuel, and provision has been made for increasing this number if necessary. The furnaces are of very heavy and substantial construction and are arranged to use either gas or oil. The regenerative furnaces are become prohibitive, a producer can be installed. At the south end of this aisle is a specially designed continuous coal-

G. D. SMITH.
General Superintendent.

fired annealing furnace into which the castings are run on trucks. Next to this is a tank built of concrete for the purpose of quenching manganese castings.

Lettering the longitudinal aisles consecutively from the west side, aisle A is occupied by the open hearth furnaces, etc.; aisle B is the casting floor; aisle C contains the drying ovens, and aisle D is the molding floor.

The last mentioned floor is served by a Dominion Bridge 20-ton crane and a Morgan 30-ton crane. Moulding sand enters at the north end in specially built cars and is handled by a single line grab bucket operated by the cranes. On the east side of the bay are six wall jibs with air hoists for handling flasks and moulds. The flasks are almost all sectional, of heavy cast steel and are, of course, of all shapes and sizes.

When ready for drying the moulds are placed on trucks on the moulding floor and pass into the drying ovens in aisle C. The battery of drying ovens is seen in the illustrations on pages 326 and 327. They are all equipped with Kinnear rolling doors. In the south end of this aisle is the core-making department, the core ovens being in line with, and on the south end of, the mould-drying ovens. When sufficiently dried the moulds are pulled from the ovens to the casting floor, aisle B. The crane equipment in this aisle comprises one 20-ton Dominion Bridge, and one 30-ton and one 40-ton Morgan. For taking the steel from the

VIEW OF DRYING OVENS FROM CHARGING PLATFORM.

POWER HOUSE.

furnace there are two 35-ton and three 24-ton ladles of usual type. They were built by the John McDougall Caledonian Iron Works, Co., Montreal. At the north end of this aisle is the manganese oil-fired furnace, and at the extreme south end a large annealing furnace.

### The Fettling Shop.

After castings are poured and shaken out they go to the fettling shop, which extends right across the south end of the building. For handling castings in this shop there is a 30-ton Morgan, and a 15-ton Dominion Bridge crane, together with a Whiting electric traveling wall jib. There is the usual equipment of compressed air chipping hammers and small machines. The cold saws consist of one 12-inch, two 20-inch and one 50-inch Newton, the two latter being driven by a 10 and 15 H.P. D. C. motor, respectively. Most noticeable of the larger machines are the Bertram 48-inch lathe direct driven by a 35 H.P. Canadian General Electric motor, and a special Morton travelling double head shaper with 40 ft. bed, specially designed for steel foundry work on frames, etc.

The two straightening presses are located in aisle A. One is a 170-ton press with a 10 H.P. D.C. motor, the other is 400-ton with a 25 H.P. motor. Both machines were built by John Bertram & Sons, to the Canadian Steel Foundries' special design.

### Transformer House.

Power is obtained from outside sources at 10,000 volts. This pressure is stepped down to 550 volts in the transformer house, a brick and concrete building measuring 35 ft. by 10 ft. It is divided into five compartments, three of which are occupied by 3-phase, 10,000-550 volt step down transformers, while the other two serve for the high and low tension switches respectively. The transformers are self cooled, with water pipes attached in case of overload. Tile ducts carry the rubber covered cables to the power house.

### The Power House.

A view of the interior of this is shown on page 326. A Niles-Bement-Pond five-ton hand-power crane serves the full length of the building. There is a Rand air compressor with a capacity of 1,582 cubic feet of free air per minute at a pressure of 100 lbs. per square inch. A Bellis & Morcom 150 K.W., 550 volt A.C. unit serves as a stand-by in case the power from outside sources is cut off.

The 550 A.C. current as received from the transformer house is converted to 220 D.C. by means of two Canadian General Electric motor-generator sets. The larger is of 250 K.W. capacity and the smaller 50 K.W. The power delivered by the smaller unit is used for the electric welding outfit only and that from the larger unit for the cranes and other D.C. motors.

### The Switch Board.

This consists of 23 panels and was built by the Canadian Westinghouse Co. It has been liberally designed with six spare panels, to provide for any increased load in the future. Of the remaining 17 panels one is the incoming panel, power reaching the board at 550 volts. There are two A.C. panels for the motor-generator sets, the power returning to D.C. panels. The two motor-generators are not paralleled on the D.C. side, as they are used for different purposes. The switching arrangements however are such that they can be paralleled in case additional power is required on either circuit. The D. C. is distributed from three panels; two for motors and one for light.

From the transformer house, 550 volt power goes directly to two 275 K.W. transformers, and thence to the board at 220 volts. From there it is distributed from eight panels, one for lighting and the other seven for the large motors.

### Boiler House.

The location of this is shown on the general view on page 325. Standard gauge tracks run through a coal storage annex on the east side of the boiler house, the entrance to the coal store being equipped with Kinnear steel roller doors. The hopper coal cars run in on a trestle-supported track and drop the coal

CASTING FLOOR READY FOR POURING.

CASTING FLOOR AFTER A CAST.

MACHINE SHOP.

into pits which are in an extension of the boiler house floor close to the fires. There are two 500 H.P. hand fired Babcock & Wilcox boilers working at 150 lbs. pressure. Forced draught is obtained by the use of a Parson's blower. The power house is of the same construction as the other buildings with the exception of the roof. This is made of terra cotta blocks and reinforced concrete beams

INTERIOR OF FETTLING SHOP.
On the right is seen the double traveling head shaper by Morton Mfg. Co., Muskegon Heights, Mich.

16 inches apart, covered with 4-ply Barrett specification roofing.

### Machine Shop.

The machine shop has a total size of 203 feet by 86 feet, the entire area being served by two five-ton three-motor Niles-Bement-Pond cranes. The crane way is carried from the roof trusses, no central columns being used. This was done to secure free space for laying out steel railway intersections, which are finished in this shop. The equipment differs from that of the ordinary machine shop, in that it consists largely of swing frame grinding machines. These are used for finishing manganese switches, diamonds, etc., which cannot be machined by steel tools on account of their hardness. The floor is of wooden blocks as in the pattern shop.

In addition to the swing frame grinders mentioned above, the more important equipment in the machine shop includes: a 48 in. x 48 in. x 12 ft. motor driven open side planer by the John Bertram & Sons Co.; one motor driven 6 ft. radial drill by the Canada Machinery Corporation; one belt driven 6 ft. radial drill of the same make; one 3 ft. belt driven radial drill, also by the Canada Machinery Corporation; one 14 in. Leblond engine lathe; one 14 in. quick change back geared lathe (Leblond); one 20 in. by 12 ft. engine lathe by the Hamilton Tool Works, Hamilton, Ohio; one No. 3 bolt cutter by Brown & Co., East Hampton, Conn.; two 20 in. vertical drills by A. A. Jones, Pollard & Shipman, Leicester, Eng.; one 6 in. high speed draw-cut saw by the Racine Tool & Machine Co., Racine, Wis.; and a motor-driven No. 4 floor grinder by the Bridgeport Safety Emery Wheel Co., Bridgeport, Conn. Further equipment will be added as required.

### The Pattern Shop.

The pattern shop is 112 feet long by 53 feet and employs at present about twenty-five men. The most interesting feature of this building is the floor, made of wooden blocks placed grain up on edge. Each block is 6 in. deep, 3 in. wide and 7 in. long. They are set on 4 in. of solid concrete base which is covered with ½ in. of loose sand, on which the blocks are laid. They are grouted between to about half way up the depth only, the balance of the space being left empty and allowed to fill with sawdust. It was desired to avoid tar on the floor of the shop, as this would make it difficult to sweep in hot weather. The shop is lighted by three rows of 500-watt lamps. One row of six lamps runs down each side wall and one row down the centre.

The pattern storage building is located about 60 feet from the pattern shop and measures 102 ft. by 52 ft. It is a two-storey building of fire-proof construction, fitted with a fire sprinkler system. Heavy patterns are raised to the upper floor by an elevator.

### Forge Shop and Oil Storage.

There is a small temporary forge shop giving employment to about ten men. A permanent steel and concrete building will be erected in the near future.

The oil storage house contains five steel storage tanks of an aggregate capacity of 90,000 gallons. These are filled by gravity flow from tank cars, the oil being thereafter circulated to the furnaces by a motor driven rotary gear pump.

### Testing of Materials.

The inspector's room will contain a motor driven Olsen tension testing machine. There are also physical and chemical laboratories. The chemical laboratory is equipped with a microphotographic apparatus and an electric muffle furnace, the latter being built by the Multiple Unit Electric Co., of New York city. All the heating in this laboratory is done by electricity, and it is one of the few rooms of its kind in which a bunsen burner cannot be found.

### Heating and Lighting System.

For lighting, 220-volt, 550-watt Tungsten lamps, equipped with Benjamin shock absorbers, are used in all the buildings. This voltage was used to prevent the possibility of the employees taking the lamps home with them. All the buildings are supplied with steam from a central power house for heating purposes, the overhead system being installed in the foundry. The heating apparatus was installed by the National Boiler Washing Co., of Montreal, as was also the sprinkler system which is placed in all necessary parts of the plant. All pipes and wires from power and boiler house to foundry are in an underground

OPEN HEARTH FURNACE CHARGING FLOOR.

tunnel which is of sufficient size to allow workmen to pass through.

### The Water Supply.

A pump house at the water edge houses a 5,000-gallon per hour centrifugal pump with 150 ft. lift. It was built by the John MacDougall Caledonian Iron Works, and is driven by a 35 H.P., A. C. motor supplied by the Allis-Chalmers-Bullock Co. This pump forces water up to a 50,000-gallon storage tank situated on a specially built tower. The tank is located between the power house and the foundry and can be seen in the illustration on page 325. This tank supplies water to every part of the plant.

### Shipping Facilities.

An elaborate system of tracks has been laid down in order to give convenience in the shipping and receiving of manufactured products and of raw material. These tracks connect with the C. N. Q. Ry. The property borders on the river and it is the intention eventually to build a wharf with a track leading to it. The company will thus have their own docking facilities for receiving raw material and shipping the finished product either up or down the St. Lawrence.

The yard is served by a locomotive, and also by a heavy locomotive crane, the latter having a capacity of 17 tons. There is an electro-magnet weighing about 3,000 lbs., which can be attached to the end of the boom. Its lifting capacity is 5 tons. This equipment is extremely valuable for loading and unloading steel and iron, as no time is wasted attaching the hook to the load. The crane has its own generator delivering power at 275 volts. The truck is 25 ft. long and weighs 57 tons. It was manufactured by the Industrial Works, Bay City, Mich.

The Canadian Steel Foundries use a gasoline motor-truck for local delivery of heavy pieces from the foundry. More of these vehicles are to be secured and a garage is to be built.

### Welfare of Employees.

For the benefit of employees a lunch room has been built. The tables run the whole length of the room and seat about 500 men. The company owns another large house near the works which is used as a dining-room for the office staff. There is a hospital room, 15 ft. by 20 ft., well lighted and equipped with hot and cold water and other necessary apparatus and supplies. A doctor visits the plant three times a week at the expense of the company and gives consultation free to all employees. Those injured in the works are visited at their homes.

The wash basins and lavatories are in a separate brick building, designed specially for the purpose. One end of this building is fitted up for the use of foremen. Throughout the foundry are sanitary bubbling drinking fountains.

An employees' magazine is published for the Canadian Steel Foundries and the Canadian Car & Foundry Co., and some 6,000 monthly copies are given away to the employees. Each issue con-

W. W. BUTLER
Vice-President, Canadian Steel Foundries, Ltd.

NATHANIEL CURRY
President, Canadian Steel Foundries, Ltd.

tains about 35 pages. It is well illustrated and contains for the most part information concerning the various plants and employees. There are also business and humorous articles and a small amount of technical matter.

### Personal.

Mr. Geo. D. Smith, the general superintendent of the Canadian Steel Foundries, was organizer and manager of the Canadian Switch Co., which started business with $35,000 capital twenty-four years ago, and finally became the Montreal Steel Works. Previous to his connection with the Canadian Switch Co., Mr. Smith was employed by the John MacDougall Caledonian Iron Works Co., by prominent companies in the United States, and by the C. P. R.

The superintendent of works is Mr. J. T. Merritt, who has been engaged in the steel foundry business in the United States for thirty years. He has superintended the building of seven plants.

Mr. W. E. L. Dyer, A. M. Can. Soc. C.E. is mechanical engineer and was responsible for a great deal of the equipment installed. He entered the employ of the Montreal Steel Works eighteen years ago and rose to his present position.

### Directors.

The directors of the Canadian Steel Foundries, Ltd., are:

Nathaniel Curry, President.

W. W. Butler and K. W. Blackwell, Vice-Presidents.

W. F. Angus, Vice-President and Managing Director.

F. A. Skelton, Secretary-Treasurer.

E. G. Jackson, Sales Manager.

W. S. Atwood, Chief Engineer.

G. D. Smith, General Superintendent.

A. H. Chave, General Purchasing Agent.

W. F. ANGUS,
Vice-President and Managing Director Canadian Steel Foundries, Ltd.

## STRENGTH OF OXY-ACETYLENE WELDS.

THE exact strength of a weld made by the oxy-acetylene process is always something of a mystery to boiler makers, and the average boiler maker is usually very cautious in subjecting an oxy-acetylene weld to excessive stresses. At the Twentieth Annual Convention of the International Railroad Master Blacksmiths, held in Chicago in August, Mr. C. J. Fackler, of the American Car & Foundry Co., Jeffersonville, Ind., described some of the tests that he had made on the strength of oxy-acetylene welding, and the results of these tests will undoubtedly be of interest to boiler makers. The Davis-Bournville welding system was used, and five welds were made in ⅜-inch and ⅝-inch round mild steel rods 18 inches long. These were bent on the anvil in the shape of a coil spring.

The rods were given rough treatment, as it was the object to break them if it could possibly be done. There were three fractures in the ⅝-inch piece and one in the ⅜-inch piece, which were due to carelessness on the part of the welder and not on account of the system. Two pieces of 2-inch by 2-inch mild steel were welded together, and after being brought up to a high heat the piece was drawn down to one-fourth of its original size. A slight fracture was found in one corner. The piece was then bent back and forth in an attempt to break it, but no fracture occurred. Mr. Fackler, therefore, expressed his conviction that a weld can be made on 2-inch material, but that a good operator should do the work.

The usual run of work which is used in the shop with which he is connected is on light stock, such as 3-16 inch plates, making welds from 6 inches to 8 feet in length. If the work is placed in the hands of an experienced welder it has repeatedly been demonstrated that reliable welds can be obtained.

## THE UNITED SHOE MACHINERY COMPANY.

THE texts of the majority and minority reports in the United Shoe Machinery Co. case were made public recently. The majority report finds that the company "is a combine, and by the operation of the clauses of the lease which restrict the use of the leased machines in the way set forth, competition in the manufacture, production, purchase, sale and supply of shoe machinery in Canada has been and is unduly restricted and prevented. In view of the circumstances of the case, however, we consider it necessary that the delay of ten days prescribed in Clause 23 of the Act, be extended to an additional period of six months and we recommend that such delay be granted." The clause referred to provides for a penalty of $1,000 per day, after ten days, if the offence is continued.

The minority report concludes:—"Considering the company's methods as a whole, I cannot find that they are against public policy."

### EFFECT OF COMPRESSED AIR ON WORKMEN.

IN England, experiments have been made to test the effects of compressed air upon the human organism, by means of a steel cylinder large enough to contain a man lying upon a mattress and furnished with a glass window and apparatus for gradually increasing, and afterward even more gradually decreasing, the atmospheric pressure.

These experiments show that the evil effects experienced by divers and laborers in caissons are due entirely to a too rapid diminution of the pressure on emerging from the diving-bells or caissons. This is explained by the fact that the quantity of nitrogen absorbed by the body rapidly increases with the pressure. When the pressure is too swiftly removed the absorbed nitrogen forms little bubbles in the tissues, and especially in the capillary vessels, with serious consequences that may be avoided completely by a very slow and gradual return to ordinary atmospheric pressure.

### STORAGE OF COAL IN WATER.

IN order to provide against the risk of a shortage of coal through labor or other causes, the Omaha Electric Light and Power Co., Omaha, Neb., have built a submerged storage pit capable of holding 6,000 tons of coal under water. The purpose in placing it under water is to avoid loss in calorific value by exposure to air and to prevent ignition by spontaneous combustion. Last winter the company were called upon not only to maintain their own service but to supply coal for household consumption and for some outside refrigerating plants. With this in mind, the pit has been arranged so that a maximum storage of 10,000 tons is possible.

The floor of the pit is carried on piles which are driven through earth and quicksand to solid rock, and are capped by concrete blocks 30 in. square and 12 in. thick. The piles are driven on 5 ft. centres under the entire floor area, the object being to have all the weight of the coal taken by them and not by the earth. The rock is from 25 ft. to 35 ft. below the surface of the ground, while the distance from the floor of the storage pit to the ground level is 14 ft. The pit is placed near the power-house, and between it and the power-house are two receiving hoppers, over which runs a siding from the railroad. A traveling grab bucket crane is placed over the hoppers and the pit, one end running on a girder on the power-house and the other on the top of a concrete wall about 26 ft. above the ground level.

The cost of the entire installation was about $30,000, of which approximately $8,000 was for the foundation work.

# The Prevention of Electrical Accidents

By H. M. Gaisman

*Electricity is such a commonplace in the manufacturing world to-day, that many of us are disposed to treat it more or less familiarly, and thereby overlook its danger possibilities. The writer of this article points out clearly and concisely many of the contributory causes leading to accidents, and indicates the mode of procedure necessary to offset these.*

IT is hardly possible to limit accidents entirely, but they may be greatly reduced by a careful study of the conditions. It is well to know "how to act" after an accident has happened, but it is a greater thing to prevent its happening. It is only natural to ask, "Why should we be interested in preventing accidents?" Briefly, the answers are:—First, every employer realises sooner or later that accidents represent considerable loss in money due to the liability incurred, incapacitating skilled employees and disorganizing his business. Accidents directly affect him commercially, to say nothing of the humane side. It is obvious that if an employee cooperates with him towards reducing accidents, he becomes more desirable and more highly valued. Second, from a humane point of view, an employee owes it to his fellow-employees and the public, as well as to himself and those dependent, to prevent accidental death and physical and mental suffering.

#### Lack of An Electrical Sense.

To the person of average intelligence, electricity is a rather mysterious thing, and there is a general feeling that everything electrical is dangerous. On the other hand, electrical accidents are often the result of disregarding natural laws applying to electricity, and a failure to appreciate the risk involved. It is a well-known fact that when the origin of a fire cannot be positively ascertained, it is attributed to the electrical wiring, where such is present. Nevertheless, the fact remains that electrical work must be considered as hazardous. It is, therefore, especially important to safeguard everyone concerned against injury. This may be in the mine, overhead, on the highway, in the mill, at the factory or the shop, in the power house, or the home. The importance of this can only be fully appreciated when we recall how little is generally known regarding electricity, that a voltage as low as 50 may prove fatal, and that moving machinery is essential to generate and usually to transform electrical energy. We can see dangerous moving machinery, hear the noise that indicates trouble, feel the heat from hot bodies before we come in contact with them, but we lack an electrical sense to detect the presence of electricity by our physical organism. Within the last decade, more or less systematic work has been done in the way of minimising accidents along industrial lines, and some legislation has been enacted in this direction.

#### Contributories to Electrical Accidents.

The general conditions giving rise to electrical accidents are the same as for all other industrial accidents. Among these might be mentioned the following:—Inevitable; lack of skill; carelessness; ignorance; absentmindedness; lack of guards; insufficient illumination; overwork; intoxicants; disregard of rules; lack of inspection; confusion of orders; misunderstanding; clothing; lack of supervision and management; absence of signals; lack of visual danger signs; lack of preparation before starting machinery; cleanliness, orderliness.

**Inevitable.**—This covers accidents that could not be prevented and for which no one in particular can be held responsible. In general, such accidents never happen twice in the same way, and there is usually a combination of circumstances leading up to the accident which could not possibly have been foreseen. Statistics from Germany show that this class covers 42 per cent. of the accidents, the remaining 58 per cent. being due to negligence of employee or employer.

**Lack of Skill.**—The same report from Germany shows that 20 per cent. of the industrial accidents which occur are due to lack of skill. It is therefore important that no man be put on a job unless he has had sufficient drilling or experience to make him skilled at the work. This is particularly applicable in electrical work, where men have to be drilled and trained in any particular branch of electrical work on account of the lack of suitable skilled labor.

**Carelessness.**—It is a well-known fact that familiarity breeds carelessness or over-confidence. This is a case of "knowing" and not "acting" accordingly. When carelessness becomes habitual, the employee should be transferred to work where there is less or no risk.

**Lack of Guards.**—Fully eight per cent. of German industrial accidents are due to the absence of guards. The guard may have been provided originally but not replaced by the employee when once removed. Such guards should be used

to protect one from coming in contact with moving machinery, getting in the path of moving machinery, and falling into openings such as in the floors of buildings, or from walk-ways, platforms, and stairs.

**Insufficient Illumination.**—It is estimated that 25 per cent. of industrial accidents are due to insufficient illumination. This is particularly true where workmen pass from daylight to places lighted artificially. The artificial light may be sufficient for those accustomed to it, but the eye does not respond immediately to the change in light when passing from a very bright illumination to a place lighted at low intensity. It is therefore important that lamps be placed along walk-ways and thoroughfares rather than distributed uniformly over the whole floor.

**Overwork.**—Fatigue leads to carelessness, and long hours without rest are responsible for many accidents. The physical is so closely related to the mental that fatigue of one affects the other.

**Disregard of Rules.**—This closely borders on carelessness, but differs from it by being a wilful violation of rules, and covers such things as deeds of daring or boasting, unnecessary exposure to danger, of taking short cuts for completing a job, instead of doing it the safest way, or trespassing in forbidden dangerous locations. Rules should not be made unless they will be enforced. They should be put up in such shape and so distributed that there can be no excuse for the employee not being familiar with them.

**Lack of Inspection.**—Machinery and apparatus deteriorates and gets out of adjustment naturally, and many accidents can be prevented by a rigid methodical and regular inspection sufficiently frequent to suit the conditions and the apparatus. Whenever unsafe conditions or defects in the machinery or apparatus are discovered, the apparatus should not be continued in service, without orders from a superior, until repairs or adjustments can be made.

**Rules Applicable to Electrical Workers.**

The following are a few important rules applying to electrical workers; which rules, if observed, will reduce very much the risk of handling circuits of dangerous voltage, or of operating electrical machinery of any kind in any place.

No inspection, repairs, or changes of cables, wire, or apparatus should be conducted by anyone except those authorised.

No temporary work should be permitted unless it is good and safe enough mechanically and electrically to be permanent.

Only skilled and experienced workmen should be employed on hazardous jobs, and such work must be performed under the direction of a competent man at all times.

When instructions are not complete or not thoroughly understood, consult your superior and follow his directions.

Do not handle circuits promiscuously and do not get the idea that you are expert at it. Over-confidence breeds carelessness and accidents are the result. Competent men are cautious, only unskilled and inexperienced men take chances.

Avoid working on live circuits except where absolutely necessary, then take all necessary precaution to insulate yourself thoroughly from the ground and the neighboring wires of opposite polarity, using such means as are provided or as are proper for the risk involved.

Before mounting, examine carefully all poles, brackets, cross arms, etc., to see that they are safe. Do not work on defective poles unless they are properly guyed.

Inspect carefully all guy wires, anchorages, poles, towers, and brackets before putting up wire and straining.

Inspect all apparatus and tools used; if same are found defective discard them or have them repaired.

When handling wires of low voltage, such as for telephones and for signals, use the same precautions as in handling other wires with which they may become crossed. It is not safe to depend upon the insulation on the electric wires to protect you against shock. Insulation deteriorates with age, and especially when exposed to weather or the action of water in mines.

When working on live circuits use one hand at a time and keep the other behind the back. Shocks from hand to hand are the most dangerous.

Insulation on tools and rubber gloves are good things if they are ample for the voltage to be handled, but they are apt to prove a delusion, as they cannot be depended upon being in good condition and satisfactory for the purpose.

Linemen must always use safety belts when working overhead.

Avoid working on circuits running overhead or on lightning arresters while there is any sign of lightning.

Never depend entirely upon tracing out circuits; rather test them out with lamp, magneto, voltmeter, or other means.

When working on a dead circuit that might be made alive, treat it as alive.

Where circuits are controlled only from the power house, written instructions should be given to the man in charge of the power to open and close such switches as control the circuits on which work is to be done. The operator must place a tag on the switch, calling attention to danger of closing same before the work is finished. Before this switch is closed, see that everything is in the clear and everybody has been notified to keep away from the circuit.

It is the safest plan to short-circuit the circuit that has been made dead before working on it.

Switches and wires of high voltage should be placed out of ordinary reach. Where this cannot be done they must be properly guarded to prevent persons coming in contact with them.

Apparatus carrying over 250 volts must have its frame or case thoroughly grounded.

All wires must be supported securely on suitable insulators, and insulated platforms should be installed around apparatus of high voltage that is apt to be touched by the operator or other employees.

Lamps on circuits of 220 volts and higher should not be trimmed without using a suitable insulating platform to stand on.

When working on wires underground, special precautions must be taken on account of the dampness and the fact that grounded circuits are used in such places. The foregoing is part of the presidential address delivered before the Association of Electrical Engineers, Birmingham, Ala.

## INTERNAL COMBUSTION LOCOMOTIVE.

AN internal combustion locomotive is being built for test on the Reading railroad, and will contain a 550-horsepower, six-cylinder gasoline engine, suitable for either high-grade or low-ignition fuel oil. It is claimed that this locomotive will be capable of negotiating grades and carrying loads as great as a small steam locomotive and that the direct drive of the steam locomotive has been adapted to the internal combustion engine. A charter of incorporation has been granted to the promoters, and the headquarters of the new company, which is known as the Internal Combustion Locomotive Co., are at Washington, Pa. T H. McNary, of that city, is president

## BREACH OF FACTORY ACT.

THE heaviest penalty so far inflicted on any person found guilty of violating the section of the factory act requiring the covering of dangerous machinery was inflicted recently by Magistrate Shaw on Edward H. Newton, superintendent of the Hastings Shingle Manufacturing Co., 1355 Powell Street, Vancouver, B.C., when he was fined $250. The charge was brought by Factory Inspector C. R. Gordon. The case was hotly contested and lasted some time. In prosecuting, Mr. Gordon stated that he intended to protect, as far as he and his assistants were able, the lives of the many workmen employed in the numerous mills and manufacturing plants in Vancouver.

# Design of Snap Gauges

NO part of the organization of a modern machine shop demands greater attention or deserves to be treated with a more liberal hand than that section of the tool room which deals with standards of length, in all their numerous shapes and forms. The work of the Engineering Standards Committee has done much towards a unification of ideas on the subject of the correct limits in any particular kind of fit for ordinary commercial purposes; indeed, their labors can now be said to represent standard engineering practice to which all firms should adhere. In accepting these limits, however, and in obtaining full sets of gauges to correspond with them, many firms are apt to forget that a course of shop usage will cause gauges to lose their original degree of accuracy more quickly than might be supposed. A period of six months is sometimes sufficient for the purpose, without presupposing any extreme carelessness or rough handling on the part of the mechanics, whose business it is to use them, or of the shop clerks, whose duty it is to issue, receive, and store them. This result is due partly to ordinary wear and tear on the surfaces of the gauges, partly to wedge action set up, should the job happen to be slightly tight on one side or other of the gauge, and partly to errors in design and workmanship of the gauge itself.

### Causes of Error.

Ordinary wear and tear must occur and can be adjusted only by keeping a standard set of shop gauges which are never used in the shop itself, but exclusively for purposes of reference in the gauge room. This standard set ought to be sent once a year to a National Physical Laboratory for test against the ultimate standards there preserved. Unfortunately it is only large and wealthy firms who can afford to spend unlimited sums on their gauge rooms, and still more unfortunately not all of them recognize the necessity of any yearly test. Such firms forget that the continuous though careful usage which their own sets of standard gauges receive is in itself sufficient to cause slight variations in the original dimensions of the standards; and, further, that almost all metals are subject to secular change in length from no apparent cause—a source of error of unknown magnitude when drop forgings are involved, even though they are subsequently annealed.

All these faults are, no doubt, small, but they are cumulative in their effect. Nor is it possible to say whether any particular gauge falls just within or without any given limit without reference to ultimate standards. The positive and negative allowances on the "go" or the "not go" side of any gauge—more particularly of the smaller dimensioned gauges, up to, say, ¾ in., since these are in more constant use than the larger sizes—are so small as to be difficult to measure except upon expensive measuring machines, which are seldom found in any ordinary engineering workshop.

Again, in gauge making shops, it is not an unknown practice for a gauge to be given a tap with a hammer so as to bring it up to final standard. Gauges often sustain accidental falls, and the writer knows of one case in which a gauge was made to fall "accidentally" until it fitted a job! Apart, however, from such an extreme case, no workman will bring trouble upon himself by admitting, without being asked, that he has dropped a gauge, nor must such a proceeding be expected of him. Neither can such falls be regarded as extraordinary accidents.

### The Wedge Action.

The wedge action, to which reference has already been made, is accentuated by the fact that the working faces of most gauges are not quite parallel to one another all over their faces. It would indeed be remarkable if they were. Slight differences of the order of 1-10,000 in. or thereabouts are frequently found, but cannot be measured actually without the assistance of other gauges whose accuracy is known to 1-100,000 in., such, for instance, as the Johanssen gauges. Should this wedge-form chance to be in the direction of the overall length of the gauge—that is, with the point of the wedge facing inwards towards the centre of the gauge—more serious errors are likely to occur than if the wedge faces at right angles to this direction. A workman is naturally anxious to pass his work with the minimum of labor to himself; and if a small extra push will pass the job it is difficult to blame him afterwards when examination shows that the working faces of the gauges were themselves slightly out of parallel.

### Construction of Gauges.

This brings up the question of the design of the "framework" or shape of the gauge itself, apart altogether from the attainment of any desired degree of accuracy in the measurement of the distance between the working faces. The ordinary type of gauge found in engineering shops is of the double U type, the two U's being joined back to back, and each gauge is thus double-ended, of the ordinary "go" and "not go" types. The best gauges are made from drop-forgings, with ample stiffness in the arms, which are usually elliptical in section. The thickness of the working faces is, again, made sufficient to prevent any tendency to twist or bend about the arm to which it is fixed. The question of the adoption of some other section than elliptical for the shape of these arms might seem worth consideration, if the difficulties of drop-forging could be overcome; a U or a T, for instance, would seem preferable to the ellipse from the point of view of stiffness, which in any gauge is the primary consideration.

### Tendency to Cheap Gauges.

Unfortunately the stress of competition is now making itself felt as seriously in the gauge-making trade as in any other; and in reply to a general demand for gauges which shall adhere to the Engineering Standards report in their dimensions and yet be cheap, every effort has been made to turn out an article on which as little manual work as possible has been spent. It is a favorable expression with lawyers that there is nothing more disastrous than cheap law: it is even more true in engineering that nothing is more likely to bring about an expensive disaster than cheap gauges, because the accuracy of the work of the whole shop depends on them.

The moral to be drawn is obvious. Manufacturers requiring new sets of gauges should be careful to give an exact specification of the shape that they require, in addition to prescribing that the limits must be within those adopted as standard. The surfacing and dimensions of the working faces are points which should also receive attention: and as an additional precaution it might be specified that a weight of, say, 20 lb., when applied at the centre of either arm of any gauge, must not cause the working faces to separate by more than a predetermined limit, which should not exceed 1-10,000 in. The exact weight depends on many variables, such as the quality of steel, type of gauge, and length and shape of arm; but each case must be determined on its own merits by trial of what has previously been found to be satisfactory practice. Such a clause would protect manufacturers very largely from shop errors due to "wedge action" when the gauge is in use.

### Effects of Temperature.

The quality of the steel of which these gauges are made has not been touched on, since most makers have their own individual preferences; but the question of temperature is important, supposing the gauge and the job are not at the same temperature. This sounds a truism which it is needless to labor, because in any shop the temperature of all the steel work will be approximately the same all over the floor; yet it must be remembered that a gauge is held for an appreci-

able length of time in the hot hand of the workman, and as a consequence, differences of temperature of as much as 20 deg. F. may quickly arise between the job and the gauge. It is usually only on work of 1 in. diameter or over that any account of temperature differences need be taken, and then only when the highest degree of accuracy is desired. It is quite sufficient to handle the gauge as little as possible or to hold it with a piece of cotton waste so that it does not come into direct contact with the hand.—T. E. S.

## C. N. R. MOUNT ROYAL TUNNEL, MONTREAL.

ALTHOUGH no decision has been arrived at as to the exact system of electrification to be employed in running the cars through the proposed Mount Royal tunnel of the Canadian Northern Railway, it is almost certain that the third rail plan will be ruled out owing to climatic conditions. Already a very large quantity of apparatus for constructing the tunnel has been ordered, including six electrical Garvin air compressors, two of them being the largest in Canada. These are to be manufactured by a Chicago company, and will be driven by 400 horse-power, three-phase sixty-cycle 2200-volt synchronous motors. The remaining four air compressors, half the size of the others, will be supplied by a Canadian firm. The compressors, with a capacity of 2200 cubic feet of free air per minute, will be used to drive the drills in the tunnel and for pumping purposes. When the work of construction is over, the two largest compressors will be utilised in the yards for operating switches, testing air brakes, &c.

The Canadian Northern Railway authorities have made a contract with the Montreal Light, Heat and Power Co. for the supply of electric current. Five electric locomotives have been purchased for use in the construction of the tunnel, which will be 3¼ miles long. From the yards to the city will be 8 miles, and the whole length will be electrified. As far as the model city, 3½ miles from the city terminal, multiple unit trains, consisting of motor cars with trailers, will be used for suburban traffic; and from this point to the yards, electric locomotives for heavy traction will be employed to bring out the regular trains. At the yards these electric locomotives will be replaced by steam. The stations will be about a mile apart.

## STEELWORKS YIELDS.

IN a paper on "Steelworks Yields," read before Iron and Steel Institute, Mr. Percy Longmuir and Mr. W. H. Robinson gave the results of a very close study of the conditions of production in a steelworks engaged on products of high quality and wide variety. They took a complete working year, and in their paper showed the results obtained week by week from the more typical departments.

It appeared that the weekly yield on the average of the year's working was:—Bessemer steel, 88.81 per cent.; open-hearth basic, 95.35; open-hearth acid, 96.24; and crucible, 98.81. The percentages of "defective" and "scrap" for the four processes were respectively 0.26 and 4.06; 0.24 and 1.65; 0.14 and 2.37; and 0.52 and 14.93. The results for the rail and billet mill showed that the percentage of "good" products was 78.63 for the Bessemer process; 79.63 for the open-hearth basic; and 77.20 for the open-hearth acid. In the bar mill the Bessemer results were 94.28 per cent. good; the open-hearth basic, 95.05 per cent.; the open-hearth acid, 93.55 per cent.; and the crucible, 93.68 per cent.; while for the rod mill the corresponding percentages were 90.25, 89.98, 90.68, and 92.53. With regard to tires, the "good" percentage was 81.71 with the Bessemer and 84.42 with the open-hearth acid, scrap accounting for 14.82 and 11.94 per cent. in the two cases respectively. For axles, the weekly average showed 86.23 per cent. "good" for Bessemer steel and 85.78 per cent. for open-hearth acid, scrap accounting for 10.14 and 10.68 per cent. respectively.

## NEW COAL-MINING MACHINE.

A NEW system of coal mining now be introduced is primarily designed to cut the entire seam of coal into a granular state suitable for coking, and also to facilitate transportation, as granular or powdered coal can be pumped through pipes with aid of water at far less cost than it can be transported by rail. At the present time, 100,000,000 tons of coal are coked each year in the United States, and it is towards this material that inventors have directed their attention.

The machine is of the milling type, and in addition to cutting the coal from floor to roof into a finely powdered state it also pumps a mixture of the finely divided fuel and mine water to a distant washery, or to storage bins located near the coke ovens. This method renders unnecessary the use of explosives, and it also disposes of the coal dust. For these reasons it is claimed to be particularly safe for use in gassy mines. The machine itself is automatic, and advances along the floor by a simple hydraulic feed mechanism. Rotary cutters on the armature shaft of the driving motor are fed into the face of the seam, and they cut the coal in much the same way as wood is cut by a circular saw. In addition to its forward movement the motor is given a swinging side motion through a limited angle so that the proper width may be cut. A fire hose throws a powerful stream of water against the face of the coal while it is being cut, thus eliminating the dust and keeping the tools cool. The water carries off the product to the nearest sump, from which it is pumped to any desired destination.

## THE THOR IRON WORKS, LIMITED.

THE plant formerly operated by the Canadian Shipbuilding Company at the foot of Bathurst Street, Toronto, has recently been acquired by a company organized by a group of Toronto men. The leading figures in the new corporation, which is to be known as the Thor Iron Works, Limited, are Mr. John Malone (formerly of the Toronto Iron Works) President; Mr. John E. Russell (the well-known contractor) and Mr. Wm. Snaith (now associated with Mr. Frank Barber, civil engineer) Secretary-Treasurer. The plant is well equipped for the fabrication of steel tank and plate work, steel roof trusses and light structural work. It is the intention of the new owners, should business conditions justify, to enlarge the scope of the works to cover structural steel work generally. The further fact that the plant possesses a well equipped machine shop and one of the largest pairs of shear legs on the water front, should render it of great service to ship owners for marine repairs. Mr. Russell's thorough knowledge of marine work in general, Mr. Malone's long experience in tank and plate work, and Mr. Snaith's technical and practical ability as an engineer, should guarantee the new company's ability to make a success of their undertaking.

The works are in shape now to give immediate attention and quick deliveries on orders in the lines mentioned.

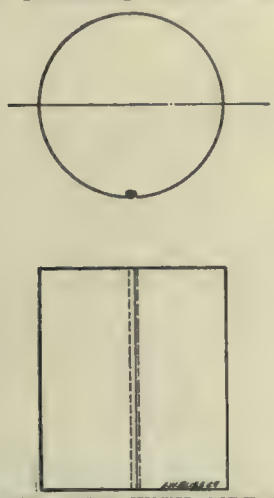
**The Canadian General Electric Co., Ltd.**, has secured control of the Allis-Chalmers-Bullock Co., Ltd., manufacturers of dynamos and other electrical machinery. The arrangements for the absorption of the latter concern by the former were recently completed. The Allis-Chalmers-Bullock Co. has a large plant at Rockfield, midway between Montreal and Lachine. The company was originally an extension of the Allis-Chalmers Co., Ltd., of the United States. The terms upon which the General Electric Co. takes over the Rockfield business are not at present available.

# Process of Manufacturing Sanitary Cans Automatically

By C. T. D.

*The article deals with the subject in a general way, and is condensed and arranged so as to make it at once readable and interesting. Much attention is at present being given the question of sanitary cans, and the process of manufacture here described enables a more intelligent grasp to be had of the progress and achievement recorded in their production.*

THE sanitary or open can, while not by any means new in this country, was not in extended use until recently, on account of the method of manufacture, which was by semi-automatic machinery. Its general use depended on the creation and development of automatic machines which would make possible manufacture along economical lines. During the last few years rapid advancement has been made in perfecting this class of ma-



FORMED BODY WITH SIDE SEAM CLOSED.

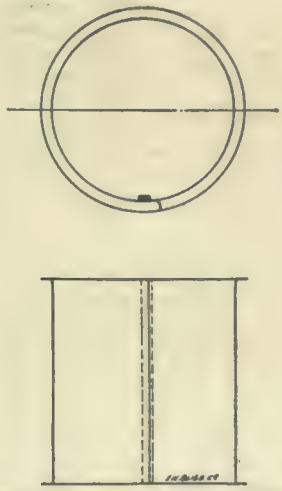
chinery, and to-day it is possible to get a line of automatic sanitary can machinery which has been tried, tested and all "kinka" removed. However, the number of plants operating automatic sanitary can machinery is comparatively small, and in view of the considerable interest in the subject we feel that the accompanying illustrations and descriptive matter will be of interest to our readers.

In Fig. 1 is shown the sanitary can plant of S. Elmore & Co., Astoria, Oregon. It will be noted that the arrangement of the machinery in this plant is somewhat different from that of the plant of the Columbia River Packers' Association, also of Astoria, which is shown in Fig. 2. In both cases, however, the cans necessarily go to the various machines in the same order of operation from start to finish; the difference in arrangement being solely due to the shape of space allotted for machinery equipment.

In the Columbia River Packers' plant, Fig. 2, the body maker is seen in the foreground. The body blanks, previously slit to size in the gang slitters (A), are placed in the receiver (B) and start from this point on their journey through the different machines until they are finally ejected from the tester (C) as a complete can with one end seamed and the can tested. During the entire course of manufacture the cans are handled automatically by the different machines and automatically carried from one to another by conveyors.

### Process of Manufacture.

In the body maker (D), the blanks are fed from the receiver (B), one at a time by means of an automatic blank separator and suction feed, which places the blanks flat on a bed and in position to be carried by fingers under the notching dies, where the four notches are cut. They are then carried further on in the machine to the edger where the hooks for the side seams are formed. The blank with the hooks formed is now passed on to the forming horn where it is rounded and held in position while the side seam is bumped or closed. From the forming and closing horn, the formed can body with side seam closed is passed on to the soldering horn, where the continuously operating chain feed which receives the can body on leaving forming horn, conveys it the length of the soldering horn, during which travel the side seam is soldered with liquid solder by means of a rotary solder roll and wiped by rotating brushes. At the end of the solder horn the can is deposited on an endless conveyor which takes it to the flanger.



SHOWING BODY FLANGED BOTH ENDS.

### Body Maker Features.

Before passing on to the flanger there are several points in the body maker which should be noted. Taking them in their sequence, as regards the operation of the machine, we come first to the adjustable feature of the notching dies, edger side gauges and feed fingers, the adjustment for all of which parts are made simultaneously by turning two hand wheels (E)—one at each side of the machine. This moves the entire mechanism at once and holds intact the

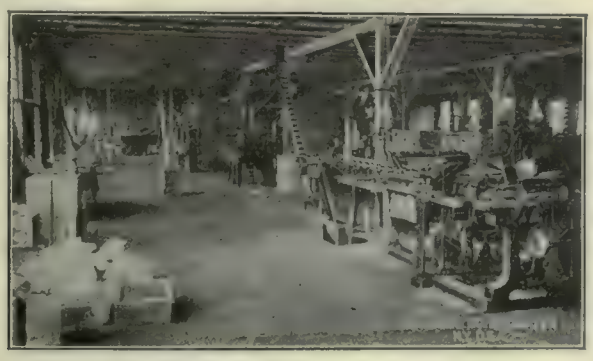
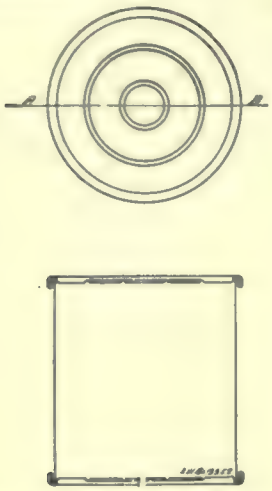


FIG. 1. SANITARY CAN PLANT. S. ELMORE & CO., ASTORIA, OREGON.

FIG. 4. BATTERY OF DOUBLE SEAMERS.

correct alignment. The edger, which is crank operated and which consists of a few strong parts, is the next feature to which attention is directed. Then, we come to the former, the horn or centre part of which is supported straight down to the bed of the machine, a feature the practical value of which will be realized by can manufacturers.



SECTION A-B

COMPLETED CAN WITH BOTH ENDS DOUBLE SEAMED.

### The Automatic Flanger.

Going back to where we left the can body on its journey through the different machines, we come to the automatic flanger (F). This machine, into which the can bodies feed automatically from the endless conveyer, automatically flanges, at one operation, both ends of the can body, and then deposits the bodies on another endless conveyer which carries them to the double seaming machines. The flanger is of the four-chuck type, the use of four chucks giving easy movements and insuring flanging without the danger of cracking the tin. The conveyer leading from the flanger feeds the three double seamers. The chute (G) is filled first, the chute (H) second and chute (J) last, after which the flanger (F) has sufficient capacity to keep all three chutes filled.

### Double Seamers' Operation.

In order that the operation of the double seamers may be more clearly seen, we will refer to Fig. 3, which shows these machines more in detail. The cans feed automatically into the machine where they are taken hold of by a device for rounding and gripping them, the can standing still during the double seaming operation. The covers placed in the magazines (K), (L) and (M) are fed automatically into the revolving dial, which dial operates in conjunction with the can feed. When the can reaches the holding device, it is raised, the cover in the dial opening is placed in position on the can body and the body, with cover on, is forced against the chuck. Four seaming rolls carried on a rotating head now come into action and seam the cover after which the rolls recede. These seaming rolls are actuated by wedges giving an even and uniform pressure. The can now drops and is carried away by the feed and deposited on the conveyer (N), Fig. 2, which carries the can to the testing machine.

Feeding down the chute (O), the cans enter the tester (C). The revolving carrier of this machine is provided with twenty-eight pockets and has a worm drive. The large number of pockets and the even and uniform motion of the carrier reduce agitation of water in the testing tank. During their entire passage through the water, the cans remain close to the surface, and leakers are readily detected. From the tester, the cans are, by means of a conveyer, carried through a drier and into the shipping room.

### Manufacture of Tops and Bottoms.

In order that the operation of a complete plant may be given, it is necessary that we refer to the manufacture of tops and bottoms. The strips from which tops and bottoms are cut are slit in gang slitters (A), and the strips in packs are placed in the receiver of automatic top and bottom presses. They are taken from the receiver one strip at a time by the auxiliary feed and delivered to the carrier feed. This carries them through the dies which cut and form tops and bottoms. Coming from this press, the tops feed through the edge curling machines. As received from this latter machine, they are ready to be inserted in the magazines of the compound applying machines (T) and (W). These machines affix to the tops and bottoms the compound necessary to insure a tight joint in the double seaming. The tops and bottoms are automatically fed from the cover magazine and clamped by revolving discs which carry them through the machine, during which travel the compound is affixed by means of rolls,



SECTION - A-B

BODY WITH ONE END DOUBLE SEAMED AND THE OTHER FLANGED.

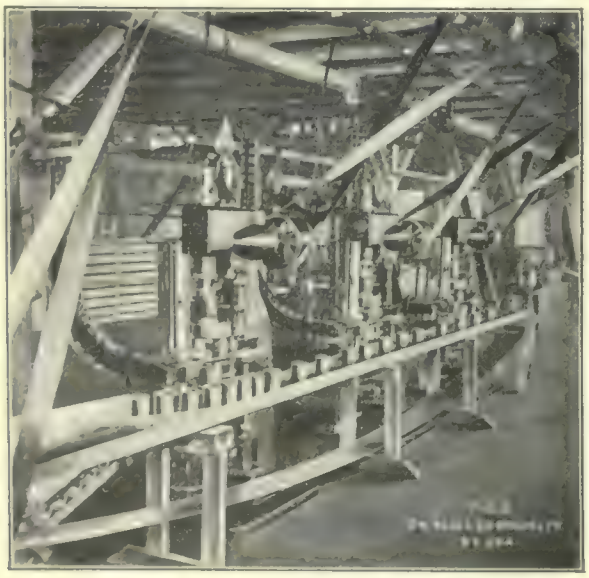


FIG. 3. DOUBLE SEAMERS' MACHINES.

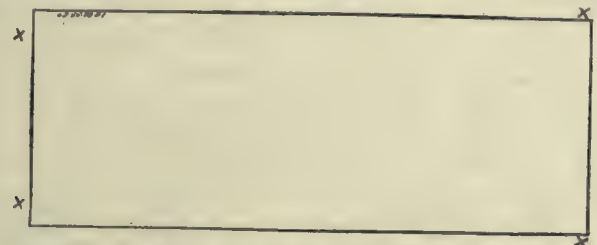
FIG. 2. COLUMBIA RIVER PACKERS' ASSOCIATION PLANT, ASTORIA, OREGON.

the compound being applied from underneath. The covers and bottoms on leaving these machines drop on the conveyer which carries them through the driers (X) and (Y), after which they are ready to be placed in the magazines of the double seaming machines. In the plants shown in Figs. 1 and 2, no packing is done; the cans in these plants being made with one end seamed and the other end open. The loose ends are shipped with the cans to the cannery where the final packing and sealing operation is done.

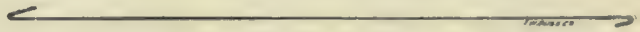
**Packing and Final Sealing.**

Fig. 4 shows a battery of double seamers in the cannery where the packing and final sealing is done, the filled cans feeding automatically from the exhausters into the double seamers. The operation of the double seamers is the same as those in the can plant, already described. The filled can coming from the double seamer is now ready for labelling, boxing and shipment.

The entire equipment of the two plants described was built by the E. W. Bliss Co., of Brooklyn, N.Y., who make a specialty of all classes of machinery for the economical production of round, square or oblong tins.



BLANK AS SLIT IN GANG SLITTERS AND READY FOR INSERTION IN RECEIVER OF BODY MAKER.



SHOWING BODY BLANK WITH HOOKS FOR SIDE SEAM

## ROLLING MILL PRACTICE IN UNITED STATES.

IN a paper on "Rolling Mill Practice in the United States," presented before the Iron and Steel Institute in England recently, Dr. J. Puppe, of Breslau, gave details of some of the observations noted by him during a visit to America last year for the purpose of studying the latest methods and improvements in connection with rolling mills.

During the nineties, he said, cogging mills in the United States were almost exclusively constructed on the 3-high system, but since the introduction of the 4-in. billet, the 2-high reversing mill had been adopted almost universally. The 3-high mill was brought to a remarkable state of perfection by John and George Fritz, and there were still a number of such mills at work, especially where one or a very limited number of sections were rolled continuously. In rolling 4-in. billets, however, the great length of the pieces made it impracticable to use the 3-high mill, as the lifting tables could not be made sufficiently long to accommodate them, and the 2-high reversing mill had to take its place.

**Comparison With German Practice.**

In contradistinction to German practice, where the cogging mill formed the link between the steelworks and the mills for all sections down to 4 in. square and less, also for slabs and flats, in the United States it formed an integral part of a particular rolling-mill train, and performed the roughing down to a certain section only. Typical instances of this practice might be seen at Lackawanna and at Gary. At the Lackawanna works the cogging rolls served for roughing down the ingots for the billet mill, whereas the heavy rail mill had several stands of cogging rolls for that mill alone. At Gary, where the cogging rolls for the rail and billet mills consisted of separate two-high sets followed by a three-high set, the arrangement had been planned not only with the object of getting the largest possible output, but it had also been determined by the method chosen for driving the trains. In very rare instances, the cogging mill supplied the plate mill with slabs, the practice at the works of the Youngstown Sheet and Tube Company affording one such example. In all other mills visited, where slabs were rolled, a type of rolling-mill entirely unknown to the author had been developed—namely, the slabbing mill, which might be described as a universal slab and roughing mill.

**Feature of Cogging Rolls.**

The cogging rolls were generally of quite small diameter, the pitch circle of the pinions measuring, as a rule, 35 to 40 or 42 inches., the roll diameter being about 3 to 5 in. smaller. Latterly, 34 in. diameter had become the standard for such mills. On this account the roll length was much shorter than in Europe, generally not exceeding 6 ft. 6 in., as compared with 9 ft. 4 in. in German mills. The arrangement of grooves was also different, the first groove not being at the side, but in the centre, and consisting really of the smooth surface of the roll, which was kept at its full diameter at that part. The production of sections varying greatly in size was attained by giving a very high adjustment, in some cases three times as great as in European practice, where 40 in. was about the maximum. The same pressure could be applied to the rolls, while owing to the small diameter, less power was required for driving.

The "wobbler" connecting the upper roll with the pinion must be of a length corresponding to the increased height of rise, and in some cases it was found to measure 22 ft., and in another 17 ft. long. With such mills remarkably high outputs could be obtained—for instance, the cogging mill at Lackawanna turned out 500 tons in a single shift, the 40 in. mill at Duquesne averaged 600 tons per shift, and the 38 in. mill at the same works could turn out 1,300 tons per shift. These quantities, of course, fluctuated considerably, but the facility with which such large outputs were obtained was explained by the fact that the ingots were not rolled to anything like the same length as in Europe, the elongation being generally five to six times, and at most seven times. The rolling period was consequently much shorter. On timing the operations at random, the author noted that nine passes were made in 40 seconds and again in 47 seconds, seven passes in 41 to 48 seconds, and on other occasions the time was remarkably short. In the matter of rapid passes the 3-high mills showed great superiority.

**Draught of Cogging Rolls.**

Another striking difference between German and American practice was the rate of diminution of the draught of cogging rolls. Whereas, in Germany, a reduction of 14 per cent. was hardly ever exceeded and with harder material an average of 11 to 12 per cent. reduction was the rule, the reduction in the draught from one groove to the next often amounted to 20 per cent. in American practice. The roughing rolls of the rail mill at Lackawanna even gave an average reduction of 24 per cent. per pass in the first six passes. The final section of the piece after passing the cogging rolls was, of course, larger than in German practice, and varied generally from 6 to 8 in. square. The shortness of the rolling period was further accounted for by the manner of controlling the auxiliary engines, which now generally consisted of electric motors. The controllers were operated with very short levers with short ranges, and there were only three notches, stop, forward, and backward.

### Rolling Down Operation.

The rolling down operation was mostly performed in the same way as in Germany, the piece being continually turned over, and the section retaining its square form. Here and there, however, an entirely different practice was followed—for instance, in the 35 in. mill of the National Tube Company the ingot was rolled out flat in nine passes through the widest groove to a thickness of 4 in. It was then turned on edge and put through the 4 in. groove, then two passes were again made through the 12 in. groove, one pass through the 5in. groove, and, finally, one through the 7 in. groove. On account of its great width, after the first nine passes, it required to be guided into the next groove and held with hydraulically operated guides. This method had been introduced at one mill in Germany, but it had considerable disadvantages—first, the difficulty of putting the wide piece through the rolls on edge; and, secondly, a tendency to crack at the corners, owing to the material being subjected for so long in one direction to the roll pressure.

It appeared that American cogging mills differed considerably from German ones in point both of construction and design, also in the method of working, and that the high rate of production was chiefly rendered possible by the very much simpler plan of rolling, which consisted in rolling to larger sections, thus shortening the rolling period, and by the rapid and accurate handling of the auxiliary engines. The ingots were almost always heated in soaking pits which could take several ingots at one time.

### Billet and Rail Mills.

The author also referred to billet and rail mills. In regard to the latter, he said that the rapid growth of population in the United States was accompanied by an enormous development of railways, and for some years from 1865 onwards, the supply of rails could keep pace with the demand only with difficulty. In 1878 there were 11 works at which rails were rolled, the yearly output being 34,000 tons. In 1880 the number of works was the same, but the production had increased to 800,000 tons. At the present time, 32 years later, there were 14 rail-rolling mills, with a yearly output of about 3,000,000 tons. As the rate of production increased, the cost naturally diminished, the greatest economy being connected with labor. The cost of labor per ton fell from about $3.20 at the end of the 'eighties to $1.65 in recent years, wages remaining at nearly the same figure.

### Rail Output and Quality.

When a single rail mill, such as that at the Edgar Thomson works or that at Gary, turned out from 3,500 to 4,000 tons in 24 hours, it was questionable whether that amount of care was bestowed on the work which was desirable in view of the great importance of obtaining the requisite high quality in the finished rails. This supposition would seem to some extent to be confirmed by the fact that rail breakages on American railways were of much more frequent occurrence than in Europe. It must be admitted that the conditions of railway service in the United States were far more severe than in Europe, and that the loads and speeds had been very much increased since the 'eighties; but whether the number of rail breakages was due to inferior quality resulting from rapid production on a large scale, in conjunction with the acid Bessemer process which had long held the field, or was to be attributed to the severe conditions of service was a question which at all events was not yet solved. The fact was noteworthy, however, that the production of rails of special steel was now continually on the increase in the United States, and that there had of late been a considerable decline in the output of acid Bessemer rails.

## TEST REPORT ON ELECTRICAL DRILL.

THE accompanying details set forth particulars of a series of tests made on a "Standard" ½ inch, 110 volt, portable electric drill, manufactured by the Standard Electric Tool Co., Cincinnati, Ohio. The tests were made by the University of Cincinnati and were performed and are attested by A. H. Stewart and A. M. Wilson, professor of electrical engineering.

### Test Data.

| Test No. | Volts. | Watts. | Size of drill | Depth of hole | Time in sec. | Material |
|---|---|---|---|---|---|---|
| 1 | 95 | Note | ½ in. | 2 in. | 52 | Steel |
| 2 | 110 | 450 | ½ in. | 2 in. | 67 | Steel |
| 3 | 120 | 650 | ½ in. | 2 in. | 35 | Steel |

Note.—The watts of the first test varied owing to the varying load on drill as the feed was too rapid to be regular.

The tests were made by placing the electric drill in an upright position under the spindle of an upright drill press, and the press feed used to force the drill against the work.

Nos. 1 and 3 were made under the most unfavorable circumstances met with in electric drill practice.

No. 1 was made at a low voltage and the drill was worked extraordinarily hard. No. 3 was made at an abnormally high voltage, and the drill again worked much harder than it would ever be possible for it to be worked in actual practice.

In either of the above cases, the drill was not damaged in the least, either by the high mechanical strains or by overheating.

Test No. 2 was made under normal conditions both as to voltage and load applied to the machine, approximating as nearly as possible to operating conditions where the tool would be in continuous service.

The time required to drill a ½-inch hole through 2 inches of steel is quite noteworthy in the above test as it shows at even the reduced pressure of 95 volts that a rate of 1 inch in 26 seconds is attainable.

## RECORD RAILWAY BUSINESS FOR AUGUST.

THE monthly summary of revenue and expenses of railroads made by the Bureau of Railway Economics from the reports filed by the railways with the Interstate Commerce Commission shows that net earnings for August of this year were larger than of any preceding August and larger than for any preceding month with the exception of October, 1909.

The net operating revenue for the 220,405 miles of line included in this summary, amounted to $96,402,927, which is greater by $10,927,009 than the net operating revenue for August, 1911. This is an average of $437.39 per mile of line for the month, which is greater by $43.83 than the average per mile of line for the month of August 1911. This net operating revenue for each mile of line for each day in August 1912, averaged $14.11, and for August 1911, $12.70. As net operating revenue is the gross income from which must be paid taxes, rentals, interest on bonds, appropriation for betterments, and dividends, it follows that on the average, the operation of each mile of line for each day during August produced only $1.41 more for these purposes than during August of last year.

The railways were bitterly complaining a year ago that their expenditures for taxes, labor, and supplies were not leaving them enough margin with which to make needed betterments and attract the capital necessary for extensions to their track, and additions to their cars and locomotives requisite to the handling of the growing traffic of the country. It would seem, inasmuch as their expenditures are still on the up-grade, that the record breaking traffic of the present simply puts a little more cash in their pockets for immediate needs, and leaves their pressing problems still unsolved.

# Current Topics

**Gas Producers.**—In a paper on "The Operation of Gas Producers with Different Fuels," Mr. R. H. Fernald points out that certain types of fuel, such as lignite, permit a high rate of fuel consumption, especially in producers of the down-draft type. Plants are in operation that consume more than 40 lb. of lignite per square foot of fuel bed area per hour, but the majority of producers do not gasify ordinary fuels at any such rate. It is true that suction and pressure producers may be made to gasify comparatively large quantities of fuel per hour for relatively short periods, but in actual operation with ordinary grades of fuel it is doubtful if the consumption exceeds 15 lb. to 16 lb. per square foot of fuel bed area. The normal figure seems to be much nearer 10 lb., although of course, some variation should be allowed for the "workability of the fuel." Even 10 lb. may be a high figure in the case of fuels having a large percentage of ash of a sulphur content that tends to produce serious clinkering.

**Zinc Coating.**—In order to protect iron objects from rust it is customery to coat them with zinc either electrolytically or by plunging them in a bath of melted zinc after careful cleansing. The disadvantage of these methods is that a real fusion of the two metals is not obtained. As a result, the zinc coating is likely to be attacked by the atmosphere. This may be avoided, says the Chemical Trades Journal, by a recently patented process which consists in so preparing the iron that the zinc gets into its pores. After steeping in sulphuric acid, the iron is placed in a solution of mercury chloride and heated; this resulting in decomposition of the mercury chloride and precipitation of metallic mercury, which forms an amalgam with the iron on the surface. The iron is then plunged into a zinc bath heated to 500 deg., where it remains three minutes. Iron galvanised by this process shows unusually strong adhesion of coating to metal. Microscopic investigation shows that the zinc penetrates into the pores of the iron, and in case a portion of the coating is worn or broken off, the iron does not rust, owing to the presence of sufficient zinc in the pores.

**Motor Notes.**—Compound-wound motors are best suited for driving planers, slotters, shapers, rolling mills, punch presses, and other machines with a reciprocating motion of either the tool or the work. This is due to the fact that the greatest demand for power is at the instant of reversal of motion, and the series winding causes an increase of torque as the speed drops. due to the increased load at that instant. The load curve of a compound motor may be greatly smoothed out by adding a fly-wheel, and it will tend to lessen the load on the motor. For machines of the class stated, motors of larger capacity are required than for machines operating with a rotary motion and removing the same amount of metal. Fly-wheels, however, tend to reduce the size of motor required for a given machine.

**Commutator Slotter.**—Like many other companies, the Third Avenue Railway has designed and built its own form of commutator slotter, says the Electric Railway Journal. It consists essentially of a wooden carrier or bed on which the armature is placed, and of a metal stand or sliding carriage for the drive. An unusual feature is the application of the exhaust system of the shops to carry away the ground mica and copper filings. The armature bed rests on two uprights which have hand wheels at their bases for obtaining vertical adjustment. As these uprights are also movable horizontally they can be readily adapted for any length of armature shaft. Variations in the alignment of the commutator bars are corrected by means of small side screws. The saw arbor is belt driven from the countershafting at a speed of about 3000 revolutions per minute. By means of a bent lever, the operator moves the slotter backwards and forwards along the carriage. This machine now handles eight different types of armatures. All commutators are undercut to a depth of 3-32 inches. About eighteen minutes is required for the commutating pole motors, and about twenty minutes for the various older types of motors.

## POROUS METAL.

IT is a well-known fact that the alloys of certain metals in a molten condition solidify very slowly, and pass through a wide range of temperature in the act of assuming the solid state. Thus with a fused mixture in equal proportions of lead and antimony the alloy begins to become solid when the temperature sinks to 450 deg. C., but it does not become solid throughout until the mass is cooled down to half that temperature. At the higher temperature minute crystals of antimony are formed which gradually increase in size, and when at last the metal has cooled down to 225 deg. C., the alloy, which will then consist of about 87 per cent. of lead and 13 per cent. of antimony, crystallizes, forming a network of fine crystals of both metals. Between the formation of the first crystals and the point of complete solidification the alloy remains in a more or less plastic condition. Bessemer made use of this property of semi-solid alloys in order to obtain very sharp impressions of medals and coins under heavy pressure. Mr. Hanover, a Danish savant, has devised a new process, based on this property of alloys, which may prove of value in the industrial arts. He expels by centrifugal force or other means the molten part of the residual metal, filling up the spaces between the crystals, after they are first formed, and he thus obtains an extremely porous crystalline mass of any required metal, useful for making plates for storage batteries, for filling pipe-joints, and other purposes.

## MOTOR CARS IN CANADA.

IT is interesting to note how the well-being of Canada is shown in the common use of the motor car, and this despite the hindrances in the way of poor roads and other obstacles to locomotion. The bulk of the cars are imported, the greater number being from the United States, with a few from England. There are, however, seven or eight motor companies in Canada, two of which are native Canadian undertakings turning out a special type of car.

The popularity of the car is greater in western than in eastern Canada; and this is easily explained by the contrast between the topography of these two parts—the open prairie, with its trail and small rainfall, permitting easy travel in almost every direction. Doubtless, if the tests now being made of the motor car in Australia, which is very much on the same principle as the stump-jump plough, and rides over rough bush roads without jolting passengers or goods, are successful, the eastern provinces of Canada will be able to make use of motor locomotion in many districts where it is now practically impossible.

## A SOUVENIR THERMOMETER.

**The Canadian Steam Boiler Equipment Co., Ltd., 211 Queen St. E., Toronto,** are distributing among their friends an attractive little thermometer mounted on an aluminum backing. It registers from 20 below to 120 above zero Fahrenheit and is remarkably sensitive. It can be conveniently hung up in office, shop or engine room and will be mailed free to anyone writing on their firm's letterhead.

**The John McDougall Caledonian Iron Works, Ltd., Montreal,** with whom the Allis-Chalmers-Bullock Co., of Rockfield, Que., had a merger of sales interests, will, in view of the Canadian General Electric having taken over the A. C. B. Co., in future maintain an independent sales department.

## BATTERY-DRIVEN TRAIN.

THE first railroad train operated by storage batteries equipped with multiple unit control recently ran a trial trip from the Pennsylvania Station, New York City, to Long Beach, N.Y., over the Long Island Railroad. The distance, 25 miles, was covered in 57 min., and the return journey was accomplished in 53 min. The train was constructed from the designs of the Federal Storage Battery Co., Silver Lake, N.J., and is equipped with Edison storage batteries. It was built for the United Railways of Cuba and is intended for service on a branch from Havana about 100 miles long, on which a steam locomotive drawing one coach is now employed. It consists of three cars, each equipped with four 200-volt motors and 216-cell Edison batteries. The important feature is that more than one car is operated by a single controller according to the multiple unit control system.

The cars are 35 ft. 5 in. long, and are equipped with double trucks. They have four double seats and four long end seats, and will accommodate 42 passengers. When the train arrived at Long Beach, the batteries were charged for 20 min. from the third rail before the return trip was made. The battery has a capacity of 60 to 100 miles with seven hours' charging, but by giving it short intermediate charges during the day's work, a higher efficiency and a greater mileage can be secured. The power consumed by the train on its demonstration run was about 4 kw. per train mile and, with an estimated cost for power of 1 cent per kw., 150 passengers were carried for 50 miles at a cost of $2 for current.

## INCREASED PROTECTION FOR STEEL INDUSTRIES.

THE demand of the iron and steel manufacturing interests for increased tariff protection is being renewed. An influential deputation of iron and steel representatives recently waited on the Government to again urge a tariff change in their favor as a compensation for the complete stopping of the bounties last year. The deputation presented elaborate facts and figures designed to show that the present protection, said to be only about ten per cent., is insufficient to meet on fair terms German, British and American competition. When the present Government came into power the steel interests believed that their request would be favorably considered, and it is understood that when the question was placed before the Government last session a tacit promise of favorable consideration was given. However, the opposition in caucus of the western Conservative members and of some of the rural members from Ontario, led finally to the turning down of the proposal by the Government. This session the steel men expect to gain their request.

### Those Present in Conference.

The Ministers who saw the deputation were Hon. W. T. White, Minister of Finance, and Hon. Dr. Reid, Minister of Customs. They were assisted by the Government's tariff experts, Messrs. Breadner, McDougald, and Russell. The deputation included Messrs. J. H. Plummer and Hector McInnes of Halifax, representing the Dominion Iron & Steel Company; T. J. Drummond, President of the Algoma Steel Company; Thomas Cantley and John Irvine, representing the Nova Scotia Steel & Coal Company, and Robert Hobson, representing the Steel Company of Canada, Hamilton. Sir Donald Mann, Vice-President of the C. N. Railway, was also in the city in support of the deputation on behalf of the Mackenzie & Mann smelting interests.

### Present Position Anomalous.

The memorial presented to the Government noted that the protection afforded the iron and steel industries consequent upon the abolition of the bounties was now quite inadequate to enable them to hold the business they had hitherto had under the assistance of the bounties. Wire rods, for instance, were entirely unprotected, and the industry was thus in an anomalous position as compared with practically all other industries in Canada. Imports of iron and steel in Canada amounted to over eighteen million dollars, thus indicating an ample field for the growth of the home manufactured product if present tariff discriminations and exemptions were removed. Over twelve million dollars was paid by Canada under present conditions in wages to foreign workmen for iron and steel imported.

### Encourage Home Industries.

Under the policy of adequate protection home manufacturers would be encouraged and expanded, with a resulting saving of this twelve millions for Canadian workmen. This argument was expanded with the usual statements in favor of a protective policy for encouraging home industries. It was also urged that the iron and steel men had now little protection against the dumping of large quantities of iron and steel from the United States in Canada at or below the American cost of production.

## TRANSPORTING STEEL TOWERS BY MOTOR TRUCK.

OUR illustration shows one of the many uses to which motor trucks may be successfully put. This particular truck is owned by the Dominion Power & Transmission Co., Hamilton, Ont., and is used by them for transporting steel transmission line towers, for which purpose it is equipped with a two-wheeled trailer. Each tower is 41 ft. long and weighs 1,500 lbs., four being hauled at one time. This truck with seven men will deliver forty towers in the same time that one team with four men can deliver four.

The builders of the truck were the Schact Motor Car Co. of Canada, Ltd., Hamilton, Ont. It is one of that company's standard 2-ton trucks, fitted with a 45-50 h.p. engine, left hand drive and centre control. This truck has made as much as 186 miles in 24 hours through heavy mud on country roads. On one occasion the car was started on a Tuesday morning, and the engine ran continuously until the following Saturday night. These facts speak well for the reliability of the car and the good workmanship put into it.

2-TON SCHACT MOTOR TRUCK WITH 2-WHEEL TRAILER TRANSPORTING STEEL TRANSMISSION TOWERS.

**C. Durban**, of Toronto, was recently appointed City Engineer of London, Ont.

**F. A. Fisher**, of the Enterprise Foundry Co., Sackville, New Brunswick, left recently for an extended business trip to Pacific coast points.

# CANADIAN MACHINERY
## AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, the foundry, technical progress, construction and improvement.

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Vol. VIII. NOVEMBER, 1912 No. 11


## THE RAILWAYS AND SUPERHEATED STEAM.

THE use of superheated steam in locomotives is making rapid headway, both on the American continent and in Europe; and it now seems to be generally agreed that greater economies can thereby be effected than by compounding.

In this connection it is interesting to note that Canada leads the world at present, as her railways, headed by the C. P. R., possess a larger number of locomotives equipped with superheaters than any other country, not excepting the United States. Several roads in Great Britain have adopted the fire tube superheater as a partial solution of the problem of ever-increasing train loads. The restricted loading gauge in that country, of course, renders any addition to the boiler power doubly welcome, so that in a few years' time it will doubtless be the exception to find a locomotive on British roads not equipped with a superheater.

Difficulties of packing and lubrication, which were serious when superheating was first introduced, are now being successfully overcome, and though the cost of upkeep on a superheater engine is slightly higher than on one of the ordinary type, this is far outweighed by the additional power gained.

## READ THE ADVERTISEMENTS!

NO business manager, superintendent, foreman or machinist can be said to have read any given issue of his trade or technical paper unless he has gone thoroughly through the advertising pages in addition to the editorial matter. Yet some readers merely give a cursory glance, or none at all, over the advertisements, careless of the valuable information they are thereby missing. To stigmatize such a mental attitude as foolish is to state the case mildly. It is comparable to that of a man who would refuse a free course of instruction in some special branch of his profession, even if it could be arranged so as not to interfere with his ordinary business and pleasures. Such a man is never in touch with the latest developments in equipment and supplies; for it is safe saying that if he will not take the trouble to read the advertising pages of a paper he certainly will not wade through complete catalogues, however few or many he may receive.

On the other hand, a reader who familiarizes himself with the advertisements finds them not the least interesting feature of the paper. He becomes thoroughly acquainted with the leading lines on the market and is quick to notice changes of copy. Readers are of course indebted to the advertisers for the fact that they are able to obtain their paper for so small an annual subscription, so that really they are under more or less of a moral obligation to study the "ads."

## CATALOGUES OR PRICE LISTS?

WE ARE frequently struck with the varying degrees of merit to be found in the catalogues sent out by builders of machine tools, power transmission appliances, automatic stokers and the whole gamut of engineering supplies. These vary to an extent that cannot be entirely accounted for by differences in the cost of production. In fact, we frequently meet with unpretentious catalogues that far outclass more elaborate rivals in the amount of useful information they contain. Of course, high grade paper, good typographical work and general artistic appearance have their undoubted value in securing a reading for a list that might otherwise be put aside unread; but the point we wish to make is that too many catalogues are nothing more than mere price lists—and practically valueless at that, since, for obvious reasons, the net prices are seldom printed.

Jones, Smith & Company, let us say, make chain hoists, screw jacks or vises. We will suppose they are not a very small concern, nor yet are they at the top of the tree. They do a nice, steadily increasing business, and have gradually worked up a fairly wide connection. Yet, their catalogue may be one of the kind that bears the firm's name on the first page, with a list of their products. Succeeding pages will have a cut of a chain, hoist or screw jack at the head, and below this a mere table of sizes and prices. At the foot of the page we read:—"Our quality cannot be excelled," or some such unconvincing claim.

Such a catalogue may be beyond reproach typographically; but consider the impression it will make on a prospective buyer compared with that of Robinson, Brown & Co., which perhaps arrives by the same mail. The latter firm are manufacturing the same lines as Jones, Smith & Co., and at about the same prices. Their catalogue, while no more elaborate in get-up and appearance than that of their competitors, gives all possible information that might help to make a sale. It may start out with a short history of the firm, written in an interesting manner. Thereafter, follows a page or two setting forth the particular advantages claimed for the articles listed. These claims are backed up by descriptions of methods and material used in the process of manufacture, and are illustrated by good half tone cuts. Without being too elementary, the catalogue, instead of assuming that the prospective buyer knows all there is to be learned about the subject, points out the chief features that should be looked for in a well designed appliance of the type in question. In short, it is a catalogue worth having, and not a mere price list.

# MACHINE SHOP METHODS AND DEVICES

**Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.**

## A SQUARE THREAD GAUGE AND PROTRACTOR.

By J. D.

THE tool here shown is a combined bevel protractor and square thread gauge; and its chief merit lies in the fact that it can be instantly and accurately set to the angle or rake required by the lathe tool for cutting any square thread. It consists of a sheet of steel (A), 3 inches square by 1-16 inch thick. Along the lower edge is marked a graduated scale representing the diameters of screw to be cut. Above this there is a series of horizontal lines representing the pitch—or lead as some prefer to call it.

A steel blade (C), having a horizontal arm at right angles to it is hinged at one corner as shown. The edges of the horizontal arm are bevelled, as seen in the end view, to suit the sliding pointer (D), which can be locked at any point along the arm. The arm is pointed at its outer end to enable it to be set to any angle by means of the graduated quadrant marked in degrees on (A). When set the arm can be locked by means of the radial slot (B) and a small screw.

For finding the correct angle of the tool a method in general use and described in many text books is as follows:—Draw two lines at right angles to each other; mark off on the vertical line a length equal to three times the diameter of screw to be cut; then mark off on the horizontal line a length equal to the pitch; draw a line connecting the two points thus obtained, and the resulting angle is the one required. It is then necessary to make a template, or transfer the angle by means of a bevel or protractor before it can be applied to the tool; and for every different diameter or different pitch the whole process must be repeated.

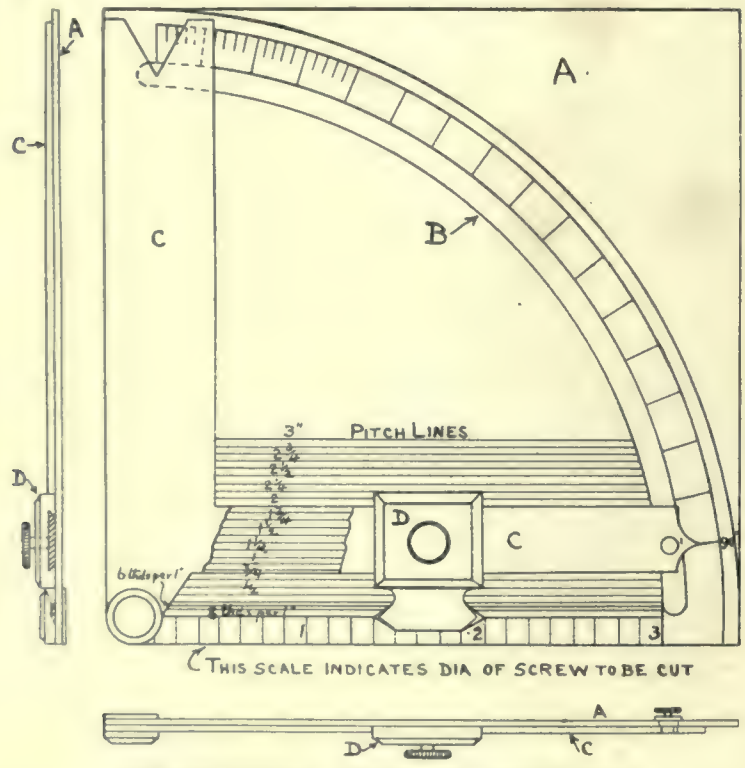
The device here shown gives the same result, but eliminates all the work, as it can be set for any thread instantly. In graduating the gauge, instead of making the graduations on the "diameter" scale equal to three times the diameter of the screw to be cut and those on the "pitch" scale equal to the pitch, it is more convenient to divide both dimensions by three. The "diameter" scale will then be graduated exactly the same as an ordinary rule; and if the horizontal "pitch" lines are spaced 1-24 of an inch apart each line will represent an increase in pitch of ⅛ inch. Of course any other scale could be adopted, provided the proportions were mathematically correct.

The two points on the sliding piece (D) are merely for convenience in setting; it is immaterial which is used, provided one bears in mind which point one started with.

The device is used as follows:—To set the gauge, move the indicator (D) along the horizontal arm until (say) the back point is on the vertical graduation which indicates the diameter of screw to be cut. Then lock (D) in position. Next push up the arm (C) until the same (back) point of (D) cuts the horizontal line which represents the pitch. Then lock the arm in the slot (B). The gauge is now set, and can be applied directly to the tool. The setting will be correct for either right or left hand threads, since the gauge being square, the top can be used as a base.

In the case of a very large screw it would be necessary to divide the diameter and pitch by two or three or any other convenient number, and thus reduce the readings within the limit of the gauge.

This device is protected by the designer, J. Davies, 3rd street, New Toronto, Ont. It has proved a great time saver in actual use.

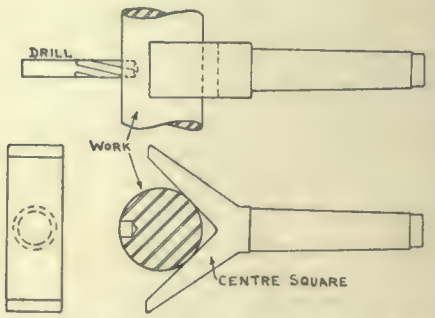



SQUARE THREAD GAUGE AND PROTRACTOR.

## CENTRE SQUARE FOR DRILLING ROUND STOCK IN A LATHE.

By F. Mayoh.

THE accompanying sketch shows a centre or pad, which is a handy addition to a lathe equipment for drilling holes on the periphery of studs or small shafts. The tailstock has its ordinary centre removed and the square here shown is substituted. The piece to be drilled is held in one hand, while the other hand feeds the tail stock spindle forward, thus forcing the work against a drill, which is chucked in the headstock.




CENTRE SQUARE FOR DRILLING ROUND STOCK IN LATHE.

This device can conveniently be made to accommodate pieces from about 5-16 inch to 2¼ inches diameter and of al-

most any length within reason. As the centre of the square coincides with the centre line of the lathe spindles the hole is bound to be drilled fair and true to the centre of the work.

## HEAT TROUBLES WHILE TURNING LONG WORK.

By F. H. M.

A VERY striking example of the expansion caused by heat while turning long work of small diameter is shown by the accompanying sketches. Fig. 1 shows a piece of steel, held in the usual manner between centres, with a following rest to support it. Although a plentiful supply of oil is allowed to flow on these pieces the expansion caused by heat is great enough to cause the work to warp and spring out of shape, unless the centre is released to allow expansion to take place.

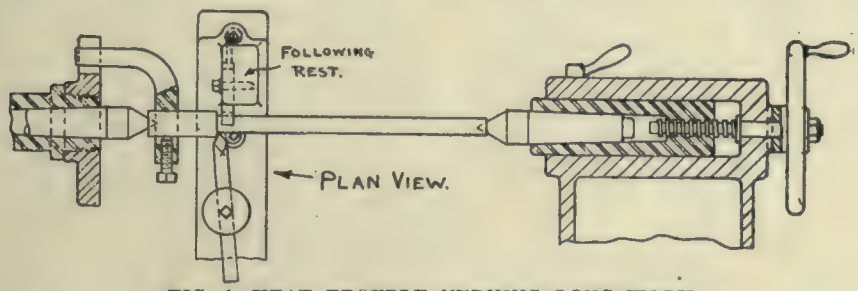



FIG. 1—HEAT TROUBLE TURNING LONG WORK.

The spring centre (Fig. 2) was designed to automatically take care of this expansion, and, as will be seen, consists of a spring, just strong enough to keep the tailstock centre firmly engaged with the work, while the following rest takes care of the thrust caused by the tool in cutting.

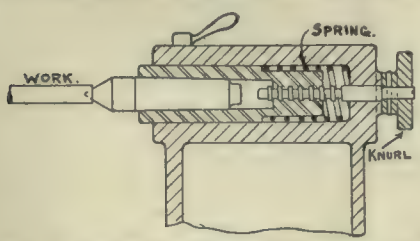



FIG. 2.—HEAT TROUBLE TURNING LONG WORK.

Unless some such provision is made, numerous small grooves are cut by the tool as the work springs away from the following rest, due to the expansion caused by the heat generated.

## MECHANICAL TRACK LAYING.

THE modern railway track laying machine is a special piece of mechanism that lays the tracks and then moves steadily forward over the rails. With this machine and a force of 18 men it is possible to lay, bolt, and spike half a mile of track a day, and, by increasing the force, two miles a day.

The cars loaded with the ties and the rails are placed at the rear of the machine so that the tie cars are in advance of those carrying the rails. The rails are drawn forward on rollers and are connected temporarily to each other. As they pass under the cars which carry the ties the latter are distributed on the rails at uniform distances. In this way the chain of rails serves to transport the ties toward the track laying machine, and as the rails enter the machine the ties are picked up by a conveyor and carried overhead, and are distributed on the roadbed at the end of a truss, reaching far in advance of the main body of the machine. In the meantime, the rails are carried forward and are deposited upon the previously-laid ties. The truss may be swung to either side to enable curves to be followed.

The track laying machine is entirely self-propelling and will haul a train of 25 or more cars of material, according to the grade. A train of 12 cars will carry sufficient material for a mile of track.

## JIG FOR DRILLING LOCK LEVERS.

By E. W. Tate.

THE accompanying cuts show a lock lever, and a simple jig which has been successfully used for drilling it. Fig 1 shows the lever, which is to be drilled at B, C and D. The hole A is drilled and reamed before the lever is placed in the jig. The latter is shown in Fig. 2. The lever is located in it by placing hole A over the stud E. The fork F then engages with the end of the handle and thus holds the lever central while the hole D is being drilled through the bushing G. The holes B and C are then drilled through the bushings in the bottom of the jig. As may be seen the fork F is pressed against the work by a small spiral spring.

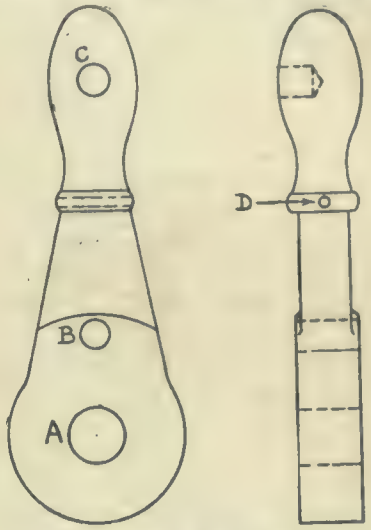



FIG. 1.—JIG FOR DRILLING LOCK LEVERS.

This jig is simple and inexpensive, yet accurate; and the idea is applicable to many similar lines of work.

## EXTRACTING BROKEN TAPS.

By J. E. N.

IT is often a very difficult job to remove a tap that has broken off short in a hole. All kinds of schemes have been tried, with varying success, for accomplishing it, and at the best it is a slow and disagreeable piece of work.

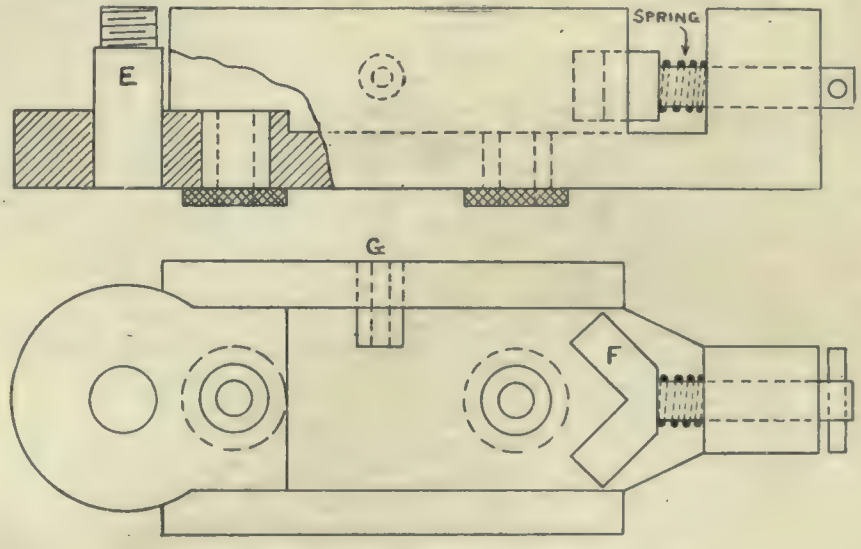



FIG. 2.—JIG FOR DRILLING LOCK LEVERS.

The device herewith illustrated has been tried with good results. A suitable piece of wrought iron pipe has one end cut into slots or tongues as shown. The other end is drilled to take a piece

REMOVING BROKEN TAPS.

of steel rod to form a handle. The slotted end is now inserted in the hole so that the tongues engage with the flutes in the tap, which is thus easily removed.

## EQUIPMENT FOR CHARGING RAILWAY BATTERIES.

THE C. P. R. have installed a complete electrical equipment at their Glen Yards, Westmount, P.Q., for the purpose of charging the railway batteries, and it replaces the old storage battery charging plant, previously used. The plant includes a C. G. E. continuous current generator, 25 kw., 200 amperes, 1200-1150 speed at full load, and 125 volts. This is direct connected to a C. G. E. induction type, 60 cycle, 35 h.p., 34 amperes, 550 volt motor. The speed is, no-load 1200 r.p.m., full load 1150 r.p.m. The displaced equipment consisted of a Royal Electric generator, 10 kw., 110 volts, 30 amperes, with a C. G. E. 10 h.p., 310 volt induction motor having a speed of 850 r.p.m., and connected to a 550 volt circuit.

## DIESEL ENGINE AUXILIARY STATION, OSHAWA, ONTARIO.

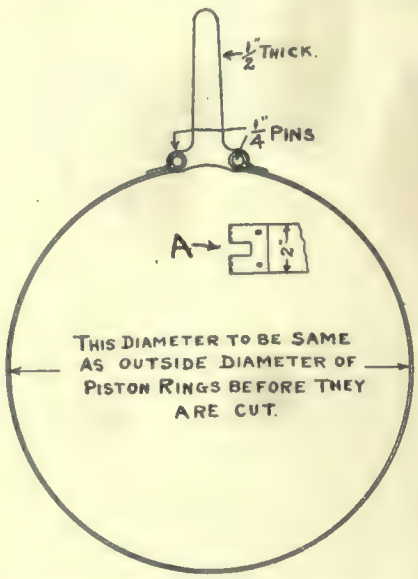
THE Electric Power Company will install at Oshawa, Ont., an oil engine plant, as auxiliary and standby for their high tension transmission system. The first installation will consist of one 650 h.p. Diesel oil engine, direct connected to a 500 kv.a., 3 phase, 60 cycle, 180 r.p.m., 4160 volt generator. The engine and generator are being furnished and will be installed respectively by Messrs. Willans & Robinson, of Rugby, England, and Messrs. Kilmer, Pullen & Burnham, of Toronto. The building being erected is designed for two units, but is arranged so that it may be easily extended to house four additional units similar to the above. The plant is arranged for standby service for the Oshawa Electric Light Co., and also to feed into the Seymour Power & Electric Co.'s 44000 volt transmission system through the step-down sub-station at Oshawa. Messrs. Smith, Kerry & Chace, of Toronto, are supervising the work.

## INSERTING PISTON AND RINGS INTO CYLINDER.

By T. R.

WITH the tool here shown it is possible to insert a piston and its rings without loss of temper and danger of pinched fingers. When, as is frequently the case, the tang of a file is used to pinch the rings into place, there is great risk of its slipping out, causing loss of valuable time and perhaps injuring the fitter and helper who have the job on hand.

To make the tool here shown procure a piece of spring steel, 2 inches wide by about 1-16 inch thick, and of a length to suit the diameter of the rings to be inserted. Bend the ends over ¼ inch pins as shown, and put rivets through




INSERTING PISTON AND RINGS INTO CYLINDER.

the lap. Next remove the pins and cut slots ½ inch wide as shown at (A). These slots take the handle which is forged to the shape shown and is ½ inch thick. Two holes are drilled in it for the ¼ inch pins and the latter are slipped through spring and handle.

The clamp is slipped over the piston rings which are compressed into their grooves in the piston by moving the handle to the right or left. The piston is then easily inserted, the cylinder simply pushing the clamp off the rings as the latter enter.

## CHARGING OPEN-HEARTH FURNACES.

IN a paper read before the Iron and Steel Institute, on the "Manufacture of Open-Hearth Steel with Reference to Improvement in Yield," Mr. F. W. Paul said that in the early practice of open-hearth steel, it was not unusual to obtain yields of 100 per cent. as an average of 12 months' work, whereas the experience of working with large furnaces during the past ten years indicated that the yield might be taken at 94 to 95 per cent. With the object of inquiring into the causes of greater metallic waste in large furnaces he reviewed in detail the operations of open-hearth steel manufacture, and gave particulars of a new method of conducting the pig-iron, scrap, and ore process, which, in a few practical trials in 80-ton furnaces, had given increased yields of 5 to 7 per cent.

A table dealing with the respective bath areas of melting furnaces employed between 1880 and 1912 showed that the area ratio per ton of charge had gradually decreased from 14.0 sq. ft. to 6.1 sq. ft. The practical limit of width of furnace between linings was reached at about 14 ft., because, if it were made wider, the cost of roof repairs would be greatly augmented; therefore, if it were desired to have an 80-ton furnace, with bath area ratio of 14 sq. ft., it would require to be 80 ft. long. Between the range of 35 ft. and 80 ft. there was ample choice, but this point was referred to merely in reference to bath area and its bearing on waste of metallic charge during period of melting and silicon elimination. It was obvious that a large furnace with reduced bath area ratio, coupled with the necessity of having a good inclined slope in the bottom to drain the metal and slag completely from the extreme ends to the tap-hole, resulted in working with a deeper bath of metal as compared with the shallow bath of small furnaces, and the author suggested that this was one of the indirect causes of less yield.

### Proposed Method of Charging.

In the new method of charging proposed by the author, instead of the pig iron being charged in one continuous operation, only a small fraction was taken, about 5 to 10 per cent., and brought to a molten state, and, thereafter, the subsequent additions of pig iron were charged into this initial bath of molten metal, which was maintained in liquid form substantially during the entire period of charging.

After the pig iron was charged and the silicon was sufficiently removed to permit of superheating the metal without loss, or after the metal had been brought to the boil, the steel scrap was charged in such increments and at such rate as was commensurate with the heating capabilities of the furnace maintaining the bath in liquid form. With regard to the use of molten pig iron in basic or acid furnaces, this method of dealing with fractions of the charge pari passu, with additions of iron oxide, permitted the

elimination of silicon at low temperature, and so avoided the fluxing of the banks, thus affording, in the basic process especially, means of working with low sulphur pig iron and greater latitude as regards contents of silicon. The heat of the flame was in direct contact with each successive addition of pig iron and scrap floating on the surface; consequently the gas and air could be maintained at their maximum, and the temperature of the furnace and metal regulated by the rate at which cold material was fed into the furnace. The pig iron and scrap floating in a molten bath of metal with a protective coating of slag were protected from the oxidizing atmosphere of the furnace. Less waste ensued, and the yield was increased.

### The Elimination of Silicon.

Another important feature of the method was the practical means of arranging the most suitable conditions for removal of silicon, and obtaining its equivalent reduction of iron from iron ore without diminishing the number of charges per week. As a result of practical trials, it had been proved conclusively that the actual theoretical yield could be more nearly approached than had been accomplished hitherto by the ordinary process. This new method of bringing each successive addition of pig iron, which was melted whilst floating, in contact with the oxide of iron in the slag was a near approach on a practical scale to the ideal of bringing in close contact each molecule of silicon and oxide of iron, so that by the time the pig iron was all charged, the silicon had been more or less eliminated under the most favorable conditions.

## LOCOMOTIVE SPEED INDICATORS.

ALTHOUGH recent railway accidents have aroused some interest in the question of equipping locomotives with speed indicators, which are in fairly wide use in many countries, it is doubtful whether the average railwayman fully recognizes the value of such appliances.

### Nature of the Mechanism.

There is more than one efficient type of indicator on the market. M. Flamand, the well-known French locomotive engineer, has perfected one that has been in successful use in France for a number of years, while another, already fitted to a few English locomotives, is known as the "Hasler" speed indicator and recorder. All devices of the kind perform two separate but related functions; they give the usual indications of the speed throughout the journey and they compile what may be called the "log" of the journey on a permanent record. The actual indication of the speed is effected by means of a mechanism very similar to that of the ordinary motor-car speedometer, a movable pointer on a dial being actuated by a simple mechanism connected with the driving wheels.

The speed records are made in a less familiar manner. Situated in a box or case, provided with a lock and key so as to prevent the mechanism from being interfered with by the engineer or train staff, is a cylinder bearing a prepared strip of paper, which is ruled for time and speed. The recorder is set in motion by winding up a clockwork mechanism. A small pen, of the kind used on self-recording barometers, is held at a short distance from the paper, and by means of gearing the pen is arranged to move up and down, its oscillations varying with the speed of the locomotive. At predetermined intervals, usually every two seconds, the clockwork mechanism forces the pen down on the paper strip, and in this way a graph is obtained showing the speed of the train at any point throughout the journey.

The phrase "at any point" is of importance. The record, which can be read off by the expert with the same ease as a musical score, not only indicates if a maximum speed not to be exceeded in any circumstances, as is the regulation in some European countries, has actually been exceeded, but shows whether the driver has ignored a speed restriction—temporary or permanent—in force on a given section of the line. That is just the kind of evidence which cannot be provided satisfactorily by means of the "passing times" recorded in the signalmen's books.

It has already been mentioned that these records cannot be tampered with by the enginemen. Where speed indicators and recorders are in use, it is the duty of some responsible official of the locomotive department to remove the records at the end of each day, when they are at once forwarded to headquarters. The examination of the records becomes a matter of ordinary office routine, and the fact that evidence of any excessive speed is automatically recorded against the driver must undoubtedly act as a deterrent.

### Speed Restrictions.

It has been asserted, mainly by railway trade unionists, that the due observance of each and every restriction is incompatible with punctuality in the case of the fastest passenger trains. Assertions of the kind have occasionally met with formal official denials, but the use of speed recording instruments would settle the matter beyond doubt. Moreover, although engineers attain wonderful skill in estimating the speed at which they are travelling, judging speed is notoriously difficult and likely to produce conflicting evidence, especially at night or in foggy weather. Therefore it is somewhat anomalous not to provide drivers with a practical instrument that shows the exact speed at all times, thereby eliminating at least one potential danger of the "human factor."

In this connection, it must be remembered that where there is an element of mystery as to the cause of an accident, the provision of speed recorders, the records of which are on the whole not likely to be destroyed beyond recognition, would enable it to be ascertained definitely whether excessive speed was a factor, because there would be evidence as to the exact speed at the moment of disaster.

**READER, WHAT DO YOU KNOW?**

**Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.**

## INDUSTRIAL ACCIDENTS.

A RECENT bulletin issued by the Industrial Commission of Wisconsin gives a report of 5,241 accidents brought to their notice during the year ended June 30, last. Of this number, 873 occurred in foundries and metalworking industries, 186 in iron and steel mills, and 195 in industries in which iron and steel products are used, including shipbuilding, wagon factories, etc. A subclassification shows that emery wheels, presses, falling objects, molten metal, and the handling of heavy pieces were, in the order named, the most common causes of injury.

# DEVELOPMENTS IN MACHINERY

## A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

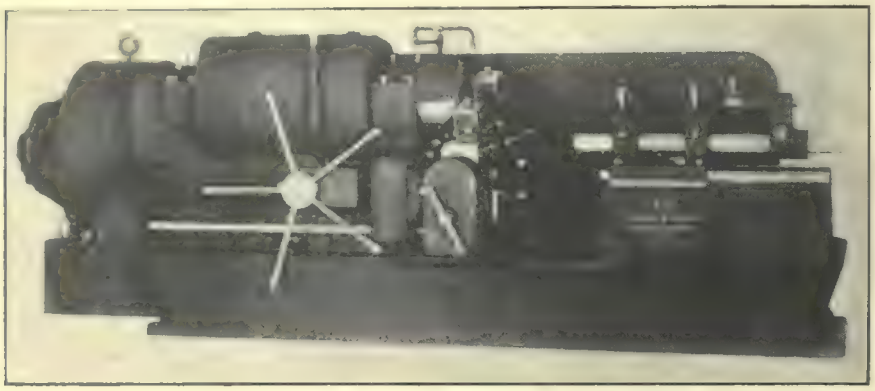
### SIX-INCH CUTTING-OFF MACHINE.

AN efficient cutting-off machine should have the following characteristics:

1.—Rapid and efficient operation in cutting.

2.—Facilities for placing and replacing, in the minimum time, stock to be cut off.

3.—Facilities for catching and removing large quantities of chips.



6-INCH CUTTING-OFF MACHINE.

4.—An ample supply of oil and the ability to make efficient use of it.

5.—Rigid and compact construction.

The Bordens and Oliver 6-inch cutting-off tool, shown in the illustration, claims to fulfil all these requirements. It has spindle speeds, varying from 20 to 152 r.p.m. The speed increments of 10 per cent. are obtained by means of a geared head and the use of a Westinghouse 15 h.p., 300 to 1,200 r.p.m. adjustable speed motor, operated with a drum controller having 16 points. The most economical cutting speeds to suit the type of cutting tools used can be obtained at all times. There is ample power available to take care of the full capacity of the tool. The power cross feed produces uniformity of speed, protecting both cutting tools and machine due to the uniform stresses produced thereby.

The automatic chuck, the adjustable stop for the stock, and the drum controller reduces the time of placing and removing the stock to a minimum. Again, the frequent trouble of getting chips caught, which would interfere with the operation of this type of tool, is eliminated by a special design of the tool slides. The support for the slides is fastened to the front of the head, which is widened on each side for this purpose. This support or bracket has openings between the slides and head allowing the chips to fall directly into the pan without possibility of interfering with the operation of the slides. It also permits of the shortening of the main bed, leaving an open space under and to the right of the cutting-off tool slides, making chip removal more convenient.

An oil pump gives an ample supply of oil to cool the cutting tools, and a pan to catch oil reduces the waste to a minimum. The illustration shows the compactness and rigidity of the apparatus, and the motor drive makes it an independent unit which can be placed in any position in a shop to suit the system of routing material.

#### Mechanical Characteristics.

The following are its principal mechanical characteristics:

Automatic chuck capacity, 6 inches round.

Hole through chuck plunger, 6⅜ inches.

Hole through spindle, 7 1-16 inches.

Front spindle bearing, 9¼ inches diameter by 8 inches long.

Rear spindle bearing, 8⅝ inches diameter by 6¾ inches long.

Cutting-off tools, ⅜ by 2½ inches.

Motor, 15 h.p. Westinghouse, type S.A. variable speed, 300 to 1,200 r.p.m.

Spindle speeds, 20 to 152 r.p.m.

Floor space, 5 feet 6 inches by 14 feet.

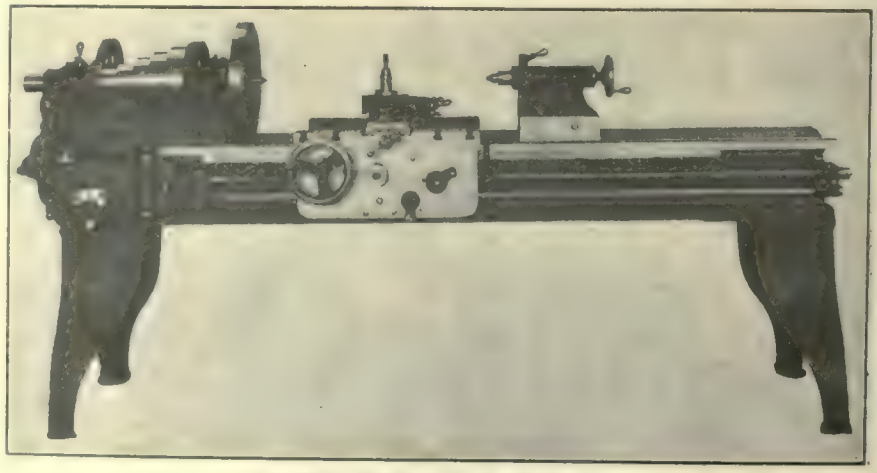
The weight including the motor is about 16,000 pounds.

### 14—16 INCH QUICK CHANGE GEAR LATHE.

THE accompanying illustration shows the new Conover-Overkamp 14-inch and 16-inch quick change gear lathe brought out by the Conover-Overkamp Machine & Tool Co., Dayton, Ohio. These lathes are built with a 5-step cone and single-back gear head stock, or large 3-step cone and friction double back gear. They can also be furnished with quick change gear box, as illustrated, or with all-geared feed box, or standard belt feed box with standard change gears. Each of these boxes is an independent unit and interchangeable one with the other.

By this interchangeability feature, either of these three units may be attached to the lathe at any time. All holes in these boxes are jigged, and alignments are made by tongue on bed and boxes. All gears in boxes are steel, and bearings are bronze bushings, quickly renewable, in case of wear, without affecting centre distances or alignments. Boxes are fastened to, or removed from bed by four bolts; changes being made in a few minutes time.

The change gear box, gear feed box, and belt feed box are new and most simple in design, having no overhanging parts at the end of the lathe to be in



14-16 INCH QUICK CHANGE GEAR LATHE.

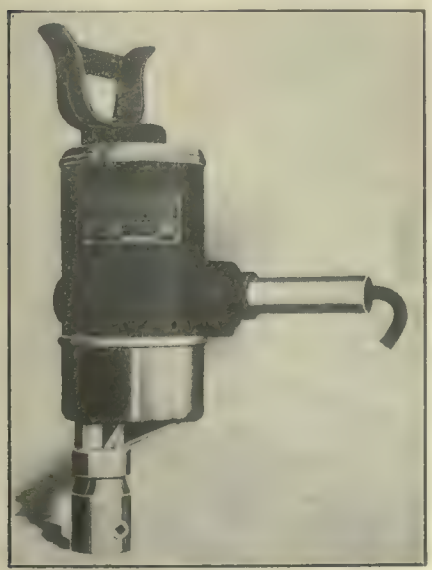
the way of operator or to take up extra floor space. The mechanism of the quick change gear box consists of a driven shaft on which the tumbler gear is mounted. This tumbler gear may be dropped into any one of the eight cone gears. In constant mesh with the cone gears is an intermediate shaft provided with four gears. The set of sliding gears may be engaged with any one of the intermediate gears by means of the lower level in front of the box. This gives 32 changes with but two operating levers, and without the removing or changing of a single gear.

A stud on reverse quadrant is provided for compounding or placing of special gears, enabling the operator to cut special or metric threads with standard lead screw. The gear feed box has four changes of feed, and is operated by one lever. The changes are obtained through sliding gears and positive clutches. Belt feed box is provided with a belt tightener.

Lathes can be furnished with standard legs, cabinet legs, and also with short legs and oil pans. Taper attachments may be added at any time as all carriages are planed and drilled before shipping.

## HIGH POWER ELECTRIC TOOLS.

THE Standard Electric Tool Co., Cincinnati, Ohio, has developed and is now placing on the market a line of high power electric tools. The drills are ball-bearing throughout. All gears are generated from chrome nickel steel, case hardened, and are mounted on ball bearings packed in grease. Bearings are absolutely dust proof. The very highest grade German bearings are used. The motors carry a very strong series winding which gives them an excess of power over rated capacity, preventing overloads and burnouts. The best machine tool practice is employed in the mechanical construction, while simplicity and strength have been carefully attended to so as to avoid complicated and weak construction.



HIGH POWER ELECTRIC DRILL.

Drills are built in ⅜ inch and ½ inch sizes for direct and alternating current. The ½ inch d.c. drill is guaranteed to ream up to 7-16 inches in thick metal. In addition, a universal drill of ⅜ inches capacity is made to operate on both direct and alternating current. These drills are built and recommended for the most rigorous and hardest constant service. All armatures and poles in both drills and grinders are built up of the best soft electrical sheet steel and are uniformly insulated.

The grinders are made for tool post, bench and parallel work. A special feature in connection with the tool post or

HIGH POWER ELECTRIC GRINDER.

centre grinder is a base which converts it into a bench grinder, by removing slide and placing motor in groove in top of base, as shown in drawing. This doubles range of work increases the value of the tool in all shops because while tool post grinders are indispensable they are used only at intervals, and by this combination they can be kept in constant service. All motors in both drills and grinders are force ventilated by fans of special design, and grinders are furnished with ball bearings, when specified, instead of phosphor bronze bearings adjustable to wear.

## A NEW ANTI-FRICTION MATERIAL

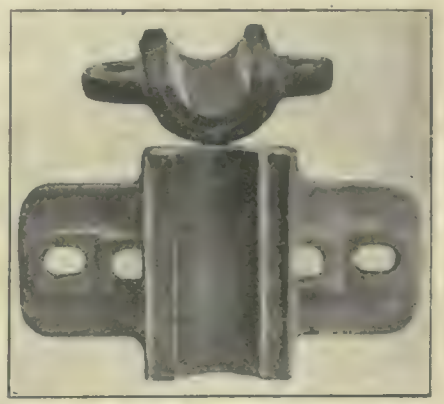
THERE has recently been placed on the market a new graphite anti-friction material which has distinctly interesting features. It has been given the trade name of "Graphitol," and is the invention of Mr. F. C. Wrinkler, manager of the British Pacific Supply Co., Victoria, B.C. Graphitol embodies the cement principle applied to the production of a lubricating material of a non-metallic nature to be used in place of metal babbitts and is a radical departure from previous practice both in

HIGH POWER ELECTRIC GRINDER.

the nature of the material and the method of applying it. It is made in the form of a fine, dry powder, which when required for use, is mixed with a prepared liquid into a stiff paste, and, without the application of heat, is put into place in the bearing box, formed or molded, and allowed to set, which it does in from eight to ten hours.

A bearing is thus obtained which is very largely self-lubricating, ensuring a low co-efficient of friction. Then, too, the heat-resisting qualities of graphite form another important advantage enjoyed by this material.

Other advantages claimed for Graphitol are:—(1) that it is very easy and entirely safe to handle, and can be used to advantage in places where it is difficult to pour molten babbitts; (2) as the material is almost self-lubricating, it requires much less oil or grease to run on than other forms of bearing material, and whatever lubricant is fed to it does not get away without being used, as the



NEW ANTI-FRICTION MATERIAL BEARING.

bearing material absorbs it; (3) the initial cost is less than with babbitts.

Graphitol may also be used as a pipe joint cement; to cure leaks in steam and

water pipes, and as a filler in machinery and parts. Used as a bearing it has absolutely no tendency to crack or disintegrate, and shows surprising endurance. We are informed that some bearings have been running for twelve months with no appreciable wear.

An interesting application of Graphitol was recently made in connection with a dynamo repair. The commutator was not a good fit upon the shaft, so it was centred by blocking and the open spaces were filled in with Graphitol in a plastic state, which was then allowed to set. In this particular instance it would have been very difficult to pour babbit; and moreover the use of Graphitol obviated the danger of babbitt getting into the commutator and causing a short circuit of commutator pairs.

### THE "BUESS" OIL-FIRED CRUCIBLE MELTING FURNACE.

A NEW oil-fired crucible melting furnace is being put on the Canadian market by the London Emery Works Co., of London, Eng. This furnace, which goes under the name of "The Buess," consists of a cylindrical steel casting rotating on trunnions. The casting is lined with refractory material having great heat resisting properties, space being left for the crucible which stands on a specially built fire brick support. Compressed air at 15 lbs. pressure and oil are mixed in the patented burner and are blown into the combustion chamber. A pure white flame completely envelops the crucible. The gases escape through an opening at the top and are used to heat the charge metal and the pouring crucible. The tilting is done by worm gear. This operation can be carried on while heat is still being applied to the metal. "The Buess" is used for melting brass, gun-metal, copper, aluminum and iron, and the makers claim the following advantages for the apparatus:—Low oil consumption, absence of clogged burner, due to special construction; saving in labor, even heating of the crucible, preheater serves for heating the charge and also for warming the pouring crucible, no costly foundation needed, and no flues. W. Frank Murphy, 55 St. Francois Xavier street, Montreal, is the Canadian agent.

**Hamilton, Ont.**, one of the leading manufacturing centres of Canada, surpassed itself in the very excellent booklet just received. Both pictorially and artistically it reaches a very high degree of merit, and the facilities enjoyed by this thriving city are brought home to the reader in terse and telling language. An excellent map accompanies the booklet. A copy may be had by applying to H. M. Marsh, Commissioner of Industries, Hamilton.

### THE HARE ENGINEERING CO., LTD.

**Mr. W. Almon Hare**, President and Managing Director of the Hare Engineering Co., Ltd., Toronto, recently returned from a business trip to England, where he was successful in raising the nec ssary capital for building the company's new shops at Galt, Ont., work on which will shortly be commenced.

The Hare Engineering Co., Toronto, has taken over the business of the Standard Engineering Co., Toronto, and will continue to manufacture that company's lines of mechanical stokers, power appliances, steel heating furnaces and rolling mill equipment. In addition they will take up the manufacture of pulp and paper machinery. At Galt a site of six acres at the south end of the town has been secured and the near future will see a thoroughly modern plant in full operation there.

The directors of the company are:—Sir Ernest H. Shackleton, C.V.O., London, Eng.; Arthur Cairn Hodge, Esq., F.R.G.S., London, Eng.; W. D. Sheldon, Esq., Galt; J. F. MacGregor, Esq., Galt; Allan Hills, Esq., Galt, and J. Otty Sharp, Esq., Toronto.

### WATER POWERS OF BRITISH COLUMBIA.

The water-power resources of British Columbia are being investigated by the Commission of Conservation and the resulting information is to be published, as soon as it can be made available, in a report to be entitled "The Water-Powers of Western Canada," which is in course of preparation. The commission has three field parties investigating the water-shed of the Fraser River above Lillooet, extending to Tete Jaune Cache and westward beyond the Fraser Lake district.

### A USEFUL BOOKLET.

THERE has just been issued by the **Smooth-On Manufacturing Co., Jersey City, N.J.**, the twelfth edition of the Smooth-On Instruction Book, which is well worth having. The great value of Smooth-On to the user lies in its peculiar chemical properties, namely, of metalizing and of expanding when metalizing, and it can be prepared to act quickly or slowly, according to the requirements of particular uses. These properties make Smooth-On a valuable substance in the making of chemical iron cements. To this subject the company's chemist has given careful study for eighteen years, and has succeeded in compounding the valuable iron cements known so generally throughout the world as Smooth-On iron cements. These cements are made each for a special purpose; they are carefully prepared, and when correctly used they make permanent repairs. The different Smooth-On cements are explained in the book, and a careful study of these will prove interesting and profitable. The illustrations are made from photographs of actual subjects, and show some of the many ways in which the Smooth-On cements have been used and the results obtained.

This instruction book will be sent free of charge to any reader of this journal who will send to the Smooth-On Mfg. Co. his name, address and occupation.

### WORLD'S PRODUCTION OF OIL FOR 1911.

According to returns recently published, the total production of oil during 1911 was 46,526,334 tons (metric) as against 43,824,304 tons in 1910. Of this former amount the United States provides over 60 per cent., and Russia just under 20 per cent.; the remainder coming mostly from Mexico, the Dutch East Indies, Roumania, and Galicia. One remarkable feature of the last year's production has been the increase in the quantity from Mexico, rising from about 440,000 tons in 1910 to 1,870,000 tons in 1911, the amount being more than quadrupled. The output from the United States increased by about five per cent. during the year, but the figures from Russia show a small decrease. It is perhaps not generally known that there is much less oil produced in Russia at the present time than there was some ten years ago.

**The Mesta Machine Co., Pittsburg, Pa.**, have issued an attractive little booklet illustrating their plant and some of its products. The latter consist principally of machinery for steel works, blast furnaces and power plants, consisting of gas and steam engines, barometric condensers, air compressors, steam-hydraulic forging and bending presses, rolling mill machinery, etc., etc., The only limit to the size and weight of machinery they build is that imposed by the limits which the railroads can handle. Castings weighing over 100 tons have been made in their foundries and finished in their machine shops. The booklet is well illustrated by a large number of half-tones, which give one an excellent idea of the extent of this large plant and of the heavy work there turned out.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

## MELTING IRON IN FOUNDRIES.

By J. F. Gaffney.*

ALMOST any kind of an old shell bricked up on the inside and having air blown in through openings near the bottom will melt iron, regardless of the size of the blower, the blast pipe and tuyers; and it is astonishing how many cupolas of this type are in use throughout the country, some of them doing fairly good work.

In the writer's estimation, the cupola is the most important thing in connection with a foundry, and he would not call a man a good, or up-to-date foundryman unless he was thoroughly familiar with cupola practice and the mixing of irons. By this I mean that he should have a thorough understanding of the effects which the different elements found in pig iron have upon each other, and upon the finished product when mixed in varying proportions. I have been responsible for the operation of many different types of cupolas, and the sketches shown here will give the reader a fair idea of one of these.

The results obtained after overhauling and fixing up the cupola were astonishing. We obtained results in three different ways, all of which helped to cut down the cost per pound at the spout. First.—We got softer and better iron, for the soft blast did not change the iron a particle. Second.—We melted more iron per pound of coke; and third, the fire bricks in the cupola lining lasted twice as long on account of the very soft blast required, which averages from 1½ to 3 oz. in the wind box. Another economy was the saving in the attendants' time. After this cupola had run continuously from 7 o'clock in the morning till 5.30 in the evening, with only a half hour for lunch, it would drop as clean as some cupolas I have seen where only 12 to 15 tons had been melted.

*(Drummond, McCall & Co., Toronto.)

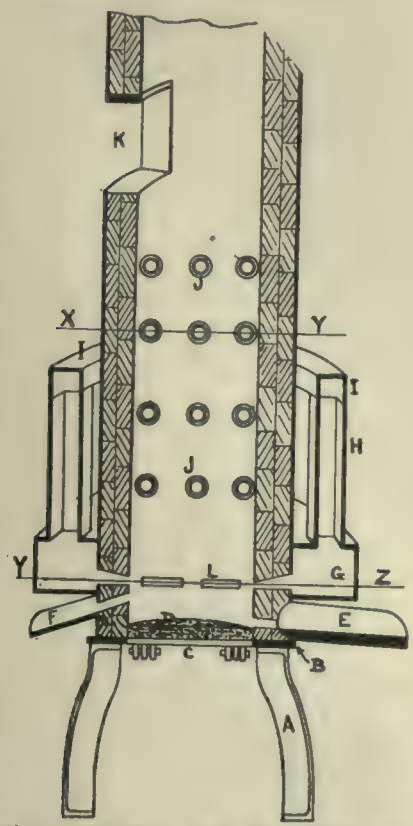



FIG. 1. MELTING IRON IN FOUNDRIES.

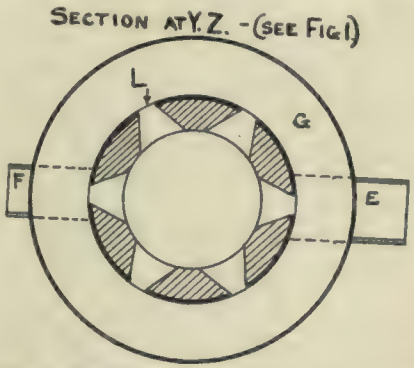



FIG. 2. MELTING IRON IN FOUNDRIES.

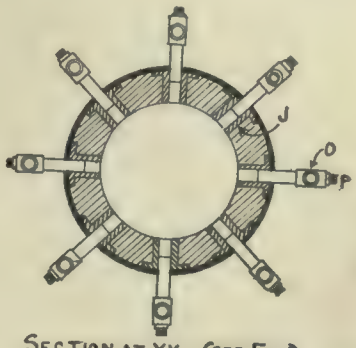



FIG. 3. MELTING IRON IN FOUNDRIES.

Almost any cupola can be remodelled into this form, as it makes no difference what the lower wind belt—(G.G.) Fig. 1, 2 and 7 is like, so long as it is large enough to supply a sufficient volume of air for the lower tuyeres—(L.), Fig. 1 and 2), and the auxiliary tuyeres (J.), Figs. 1, 3, 4, 5 and 7. The lower tuyeres (L.), and lower wind belt (G), shown here, are much the same as in the majority of cupolas. There are, however, a large number of cupolas that have not enough tuyere area. (See footnote.)

Fig. 1 shows pipes (H.H.), of which there are two to carry the air from the lower wind belt to the auxiliary wind belt (I), Figs. 1, 4 and 7, which latter supplies the auxiliary tuyeres (J) through pipes (O.)—Figs. 3, 4 and 7, which run perpendicularly above and below the auxiliary wind belt. Pipes (O) are made up from short lengths of gas pipe with a four way connection opposite, or in front of, each tuyere, with a plug (P), Fig. 4 screwed in, so that in case any of the tuyeres should become stopped up, the plug can be taken out and a small rod pushed through.

A plug (P) is also put on each end of pipes (O). The auxiliary tuyeres, set in the lining, are made of cast iron, and are shown in Fig. 5. The construction is such that they cannot work loose. They have a 1-inch hole through them, and require to be of same length as the thickness of the cupola lining, so as not

Note.—The combined tuyere area of a cupola should be equal to three times the area of the outlet of the blower, when the blower is of proper size, and it takes from 30.000 to 35.000 cubic feet of air to melt one ton of iron.

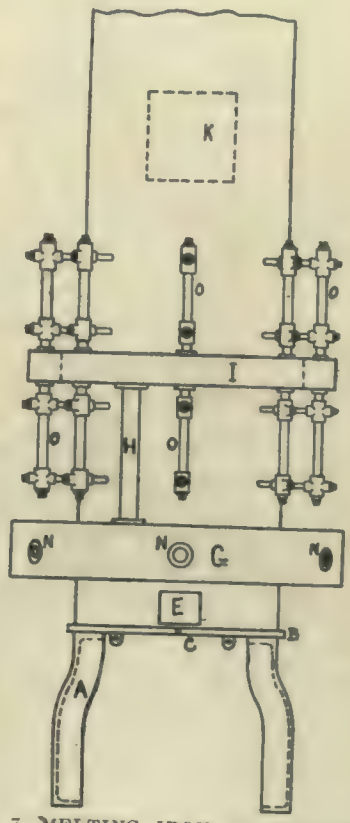
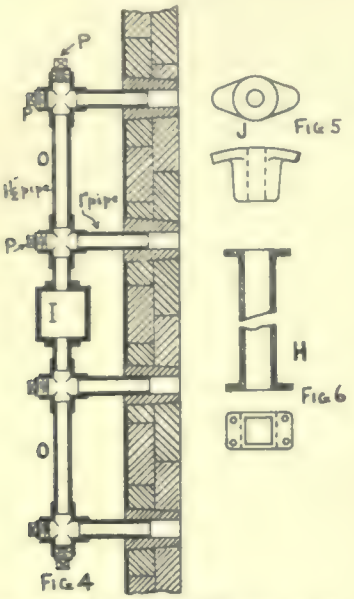



FIG. 7. MELTING IRON IN FOUNDRIES.

to project past the brickwork inside the cupola. Four rows of these auxiliary tuyeres are required, and the number to a row will of course depend upon the size of the cupola, as it is only necessary to supply enough air to ignite the oxygen and make full use of the escaping fuel gas which would otherwise be lost with the ordinary type of cupola.

The blast pipes enter the lower wind belt in the usual way and are not shown




FIGS. 4, 5 AND 6. MELTING IRON IN FOUNDRIES.

in Figs. 1 and 7. The peep holes opposite each of the lower tuyeres are indicated at (N.); the legs at (A.A.); the bottom plate at (B.); the bottom doors at (C.); the sand bottom at (D.); the spout at (E.), and the slag spout at (F.). All of these are in accordance with regular practice and general type of cupola.

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**Dr. Francis W. Merchant**, director of Technical and Industrial Education of Ontario, has gone on an extended tour to Europe to study the technical school systems in operation there.

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**Electrical Motor Trucks.**—The management of the Canadian Express Company have inaugurated a new era in transportation of expressage by installing in their service a number of electric motor trucks. Three are of two-ton capacity and two of one-ton capacity. These have a speed of from 10 to 12 miles an hour, which is more than double that of the old horse truck. They will travel 45 miles on a single charge. The large vehicles are 166 inches long over all and 76 inches wide. The others are 149 inches long and 72 inches wide, respectively.

## FIRST PRINCIPLES OF PATTERN-MAKING.*

By T. R. Schofield.

IT would seem reasonable to deduce from the previous remarks that those concerned in the economical production of castings, in order to fulfill the requirements indicated, embodying great intricacy and precision, have no small part to play in the maintenance of progress. My concern is with the attitude of the pattern-maker to these developments, how, incidentally, the foundry is affected through him, and what can be done to insure that he shall efficiently discharge his functions as a worthy member of the advanced organization of the engineering profession.

### Scope for Initiative.

The work of the pattern-maker gives more scope for the exercise of initiative than almost any other branch of engineering. It is under his hand that the work of the designer first finds tangible expression, and he is frequently intrusted with a large measure of discretion and enjoys opportunities for intercourse and suggestion with the designer. The live designer does not despise his suggestions, and the tangible expression above mentioned often takes forms which render it almost unrecognizable to the designer, who has to take him somewhat on trust, and in whom are induced feelings of respect (I had almost said awe) because of the uncertain factors which seem to surround the evolution from drawing to casting.

Many of the qualities which characterize the designer are also found in the successful pattern-maker; both perform certain duties which are but steps toward a final achievement; the actual work of each has no place in the finished product, and for this reason both enjoy the distinction of being called "non-producers." Some enthusiasts have carried the thought farther, and styled both as "necessary evils," and I have frequently heard the pattern-maker's frame linked with that of Ishmael; so that their pursuits give them ground both for mutual respect and sympathy.

### Pattern Cost Feature.

From time immemorial, money spent on making patterns has been regarded in many quarters as lost beyond recall. Certainly money spent on superflous or unnecessary work in any department is loss, but the necessity which exists for efficient patterns surely displays the inconsistency of such an attitude. The foundations of true economy must be laid, not upon such prejudice as above mentioned, but by paying the same attention to the equipment of the pattern-shop and the methods of producing the patterns as has proved so successful in the productive departments.

A pattern is a tool provided for the molder's use, but unlike most tools, it is used in a somewhat spasmodic manner. Such patterns as are used more or less continuously, i.e., standard patterns, are worthy to receive every possible attention, regardless of cost, since this is relatively small. Most patterns, however, are not used so frequently, and for this reason the relative cost increases accordingly. In any case, good castings, involving minimum labor in the foundry, and with allowances so fine as to require the minimum time for machining and fitting, demand patterns made to some recognized standard of quality. When the saving in first cost of a pattern is outweighed by the cost of extra labor in the foundry, the pattern ceases to be a cheap one.

### Pattern Relation to Foundry.

The desirable quality of a pattern, then, is measured by the facility with which the mold is produced from it. Its purpose is strictly utilitarian, and superfluous work is to be deprecated. Such a criterion might be applied to some of the ill-considered, rough, or "jerry-built" apologies with which the molder is painfully familiar, and I think it will be agreed that there is still scope for improvement. With a reasonable standard of efficiency adopted, the cost need not be prohibitive if proper equipment is provided and up-to-date methods adopted to produce the patterns. In analyzing the various operations necessary to make a pattern, it is my intention to show in how many ways mechanical operations can be used instead of hand operations, with an enormous reduction in cost. Where a broad view of economy in pattern cost is taken, so as to embrace the foundry and subsequent departments handling the work, a higher standard of finish is secured in the castings, production is enhanced, and the foundations laid for realizing more fully the great potentialities of the foundry.

### The Pattern-Makers' Work.

The work of the pattern-maker might be roughly divided under the following heads:

1—Planning or previous study of methods.

2—Machine work of sawing, planing, turning, etc.

3—Setting out and building.

4—Hand-work of paring, carving, filleting, glass-papering.

As previously mentioned, the method decided on from preliminary study of the drawing has more than a passing interest to the foundry concerned, since that department ultimately suffers from

*From a paper presented at the recent annual convention of the British Foundrymen's Association.

errors of decision at this juncture. A thorough study of the drawing by the foreman pattern-maker enables inconsistencies in design to be corrected, and modifications to be made to simplify the work both in pattern-shop and foundry. For instance, the hollow box section, beloved of machine designers, frequently necessitates cores either suspended in the cope, or insecurely balanced on chaplets in the drag, these chaplets often being cast into faces requiring to be machined, thus adding to the troubles of the machine-shop.

### Pattern-maker and Designer.

A timely suggestion being made, the designer cannot fail to appreciate the force of the argument, and small but sufficient apertures are provided, insuring proper support in prints for the core, efficient venting, and satisfactory results. Instances could be quoted where, from a simple suggestion, the whole design has been altered, with a considerable gain in all-round efficiency.

The planning of the patterns must be, above everything, thorough, and embrace all the essentials of the construction and subsequent molding; the foreman's decisions should be modified, as occasion arises, by consultation with the foundry head, whose advice and co-operation are of prime importance in securing the best results, and in avoiding those vexatious alterations to patterns often made necessary when found unsuitable to foundry conditions. This preliminary work done, the job can be put in hand, accompanied by explicit instructions; the pattern-maker can proceed in the most direct manner with the work, unhindered by doubts or fads, progressing more rapidly with it than if it were imperfectly thought out and difficulties left to be overcome as they presented themselves, which is not the modern way.

It is a mere commonplace to say that economical production is secured in any branch of business by a proper planning beforehand of the work to be done, and possible difficulties as far as possible anticipated and provided for. In work of a more or less intricate nature, involving the use of many cores, a full-sized layout of the job on a board proves most helpful. Machining allowances can thus be shown; troubles in connection with the swelling of baked cores can be to some extent provided against by allowance for this being indicated on the layout, and the energy expended in rubbing cores to fit prints can be reduced if not eliminated.

With the use of a layout, a large job may often be sub-divided to advantage, individuals each handling separate units which together make the complete pattern. By this means, precise methods of execution can be employed, and much economy of time effected.

### Pattern-Making Machinery.

The machines provided for the use of pattern-makers are the same general type as usually applied to woodwork, and include machines for sawing, planing, turning and grinding, among others. All of these are a practical necessity where a fair quantity of work is handled. Machines specially adapted to modern shop needs are available, and only require intelligent handling to justify their installation.

### Circular Dimension Saw.

The modern circular dimension saw is a precision tool; it carries two saws on separate spindles, capable of being operated alternately, by means of a hand-wheel movement. The height of the saw above the table is adjustable from zero to about 4 inches; the fences or work guides for ripping, and cross-cutting, and the work-table itself, are designed to make the machine as universal in application as possible, each being capable of an angular movement of half a right angle, a few seconds only being required to set up for a job. These features enable straight work to be sawn dead to size and angle, and worked into the job without the necessity of an intermediate handling. For example, a framed core-box is made in a few minutes, with the ends cut off to the correct length with allowance for draft, and checked into the sides. Polygons for hollow cylindrical patterns, and the lags for the same, require very little further attention; in fact, these machines are so valuable that one is led to think that it might be an advantage to have a small edition of them placed at the end of each bench, ready for the thousand and one jobs on which it is prepared to demonstrate its effiicency.

### The Planing Machine.

The planing machine is so familiar as to need little comment. We rarely find means provided by which timber may be planed to parallel thickness; where jointer and thicknesser are provided, either separately or combined as one machine, hand work of this kind is almost eliminated. If due care is taken of the cutters, many jobs such as wheel rims and other circular members may be built up with good joints, without any hand planing whatever, a matter which is worth considering as one of the many economies that can be effected.

### The Sanding Disk.

To sandpaper one's work to shape was anathema to the preceding generation of pattern-makers; we are now, without shame, grinding to shape a big percentage of our work, large and small, on the sanding disk, with results satisfactory to all concerned. The saving in cost is enormous, and its use enables many novel modes of construction to be applied, which, with the invaluable aid of leather fillets, secure the desired form and finish in a much more direct manner than is possible with hand labor. No pattern shop is complete without the sanding disk; it would be impossible to enumerate in how many ways it is advantageous, for it embraces in its scope nearly every detail of a pattern. That it is not a toy may be gathered from the fact that wheels of all sizes, up to a foot wide, are ground to shape, with correct draft, from the rough, with a speed which puts the lathe to shame.

### The lathe.

The lathe has been put partly out of commission with the advent of the sander, but has been compensated in our case by a suitably large face-plate and tilting table attachment, thus combining in one machine the functions of both, and forming an inexpensive and efficient arrangement. One might also mention in passing that lathes with wooden beds are not ideal for doing good work. Cases have been known where work a little too large has been accommodated by relieving a little out of the lathe bed; such a practice pursued for long can only end in disaster. Even where iron beds are provided, one looks in vain for the slide rest, which is as invaluable for turning wood as for most other materials, where precision and time are of importance. One can only wonder, and hope for the best.

### Pattern and Casting Relation.

It has always seemed to me, since a casting cannot be more accurate than its pattern, that the pattern deserves every care devoted to insure that faces shall be truly perpendicular, and shaft centres bear their proper relation to each other and to the faces. To insure this, the setting-out tables of the fitting-shop, with accessories in the form of angle-plate and scribing block of adequate size, are an absolute necessity in the pattern-shop. Where these facilities are provided, the work of building up the pattern, whether it be a wheel rim or a machine or engine bed, is greatly expedited; machining allowances can be cut down to a minimum, and, in short, all the advantages realized of using precise in place of rule-of-thumb methods.

In the foregoing remarks I have tried to show that foundry efficiency demands a high standard of quality and completeness in the pattern. Also that patterns capable of meeting this demand satisfactorily, while insuring castings on which a minimum of labor is necessary to machine and assemble, need not be prohibitive in cost, if methods are studied and equipment adapted to suit present needs.

## THE TUOHY BOLTLESS INTERCHANGEABLE FLASK AND FLASK BAR.

THE Tuohy boltless interchangeable flask and flask bar, illustrated herewith, can be so combined as to make up and bar any size flask from 24 inches square upward, advancing in widths and lengths by steps of 6 inches. This is accomplished by employing flask sides and ends of varying lengths provided with suitable sockets, the system being rigidly held together by simple wedges. The bars are likewise secured by double finger wedges. Neither bolts nor rivets are employed, and a common hammer is the only tool required to assemble the parts or to knock them down.

The flask and bars when in place are as rigid as those in a bolted flask, and, it is claimed will not shake loose under the most severe punishment. The bars can be raised or lowered in the flask to suit the pattern. They can be placed lengthwise or crosswise, and short bars can be inserted between the larger ones. In other words, the most complicated systems of barring, for straight work or for cheeking or chucking molds can be built up as fast as a man can move and drive in the wedges. All this is accomplished with the flask in place on the bottom board over the pattern.

Flask shop labor and material can thus be lowered very considerably and bottom board equipment is reduced to a minimum. The bars are applicable to wooden flasks, it being only necessary to cut oval holes in the sides to accommodate the finger wedges. By the employment of this bar the usefulness of the jarring machine is greatly increased for jobbing work, as copes can be as readily put up on the machine as can drags.

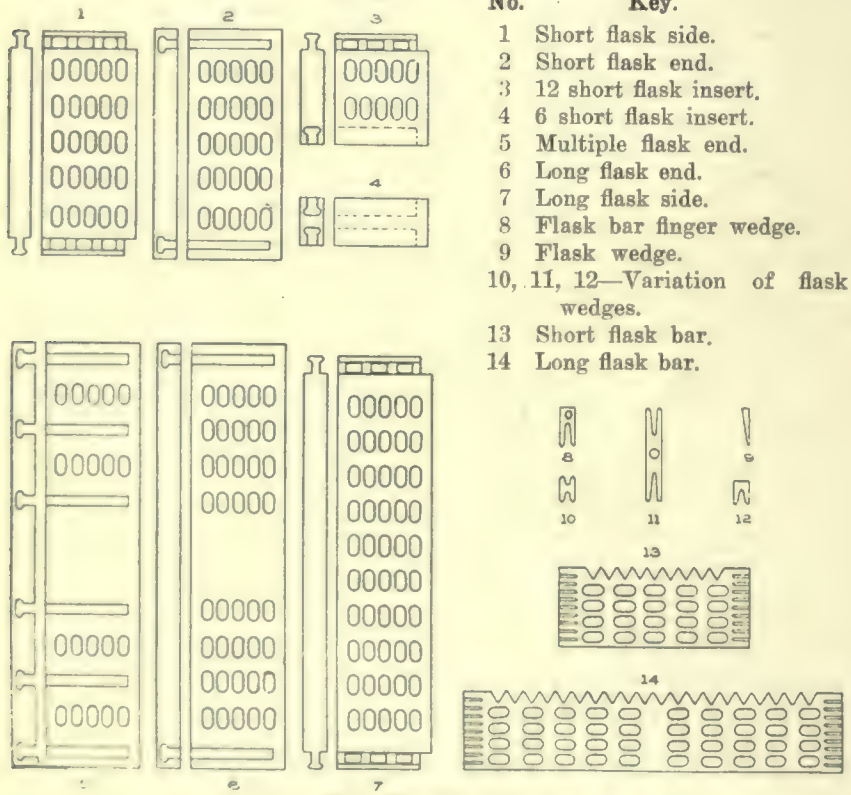


FIG. 1. THE TUOHY BOLTLESS FLASK.

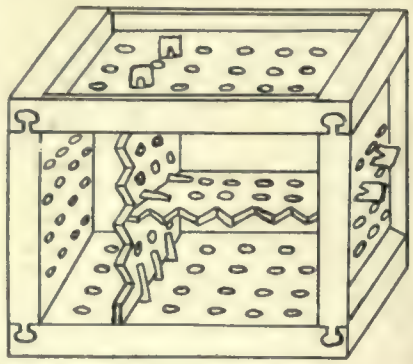


FIG. 2. THE TUOHY BOLTLESS FLASK.

This has, heretofore been impracticable, owing to the expense for barring copes. The flask parts, bars and wedges are unmachined, rough castings only, and can therefore, be made at a lower initial cost than the common flask and bar in general use to-day.

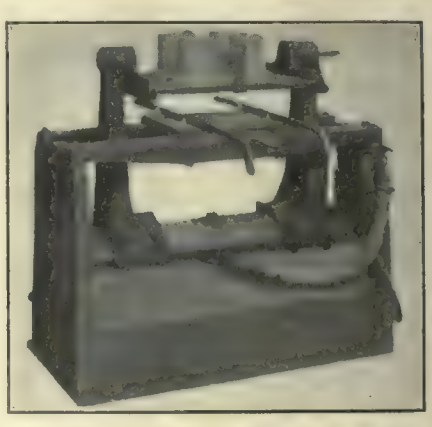
Referring to the cuts, Fig. 1 shows the various unit bars by a combination of which any size flask can be made up. Fig. 2 is a perspective view of a 24-inch flask, and serves to show how the sides and ends are interlocked and the manner in which the bars may be fixed in any desired position by means of the oval holes in the flask and the finger wedges shown in Fig. 1. The following table gives a key to the various units shown in Fig. 1:—

| No. | Key. |
|---|---|
| 1 | Short flask side. |
| 2 | Short flask end. |
| 3 | 12 short flask insert. |
| 4 | 6 short flask insert. |
| 5 | Multiple flask end. |
| 6 | Long flask end. |
| 7 | Long flask side. |
| 8 | Flask bar finger wedge. |
| 9 | Flask wedge. |
| 10, 11, 12 | Variation of flask bar wedges. |
| 13 | Short flask bar. |
| 14 | Long flask bar. |

This flask is patented by John Tuohy, Pittsburg, Contra Costa County, California, and was shown at the exhibition held in connection with the recent Foundrymen's convention at Buffalo. Mr. Tuohy does not manufacture the flask, but sells the shop rights to any foundry desiring to use it.

## A NEW JOLT MOLDING MACHINE.

AT the recent Foundrymen's Convention held at Buffalo a new direct-draw roll-over jolt moulding machine exhibited by the Osborn Mfg. Co., Cleveland aroused considerable interest. The machine, here illustrated, has a maximum pattern-draw of 10 inches and can be adjusted to take any size of flask from 10 to 30 inches outside length, and any width up to 24 inches. This adjustment is accomplished by clamping the trunnions supporting the flask, or core box, any desired distance apart on the wide crosshead attached to the ram. The arrangement may be clearly seen from the cuts, which also show the manner in which the one cylinder serves both for jolting the mould and drawing the pattern. The mould is easily rolled over by hand, since it revolves on an axis passing close to its centre of gravity. A simple locking device holds

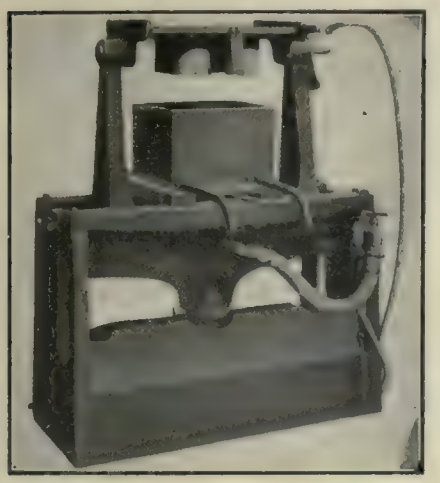


OSBORN DIRECT-DRAW ROLL-OVER JOLT WITH PATTERN MOUNTED AND READY FOR THE FLASK.

the mould in perfect alignment during the drawing of the pattern, the accurate draw making the machine very suitable for small deep castings such as are used in automobile and similar work. The table is equipped with an automatic four pin levelling device which takes up any inequalities in the follow-board. These levelling pins are all locked simultaneously by one lever. As may be seen the flask rests upon sliding steel arms and is thus easily drawn out clear of the table and removed when the pattern has been drawn.

Though exhibited this year for the first time, the machine is by no means in

the experimental stage, but has been in active operation for three years in the plant of the Ferro Machine and Foundry Co., who are large makers of automobile



OSBORN DIRECT-DRAW ROLL-OVER JOLT WITH MOULD RAMMED AND PATTERN DRAWN.

castings and internal combustion marine engines.

In addition to the machine here described, two larger sizes are made for heavier work.

## ZINC SMELTING.

IN the ordinary practice of zinc smelting, the tendency in Europe during recent years has been to drive the furnace harder and harder. A furnace temperature of 1400 deg. Cent. was once thought to be high, but now 1500 deg. Cent. and upwards is reported. Such high temperatures imply, of course, the necessity for much more substantial furnace construction and a high class of refractory material. Naturally, the average life of the retorts is reduced. The actual smelting temperature, i.e., the temperature inside of the retort, is about 100 deg. to 200 deg. less than the furnace temperature. In this particular, the electric furnace has the advantage that the full temperature of the furnace is realized in just the place where smelting is to be done. The amount of zinc remaining in the residuum, whether the latter be an ash (loose or clinkered) or a slag, depends primarily upon the temperature of the smelting and the fluxing of the ore.

Conditions favorable to low zinc retention are high temperature and highly calcareous slag. It is possible to discharge from the electric furnace a slag containing less than 1 per cent. of zinc. Such slags have been made at McGill University, and other experimenters also have done so. The ability to do this does not, however, imply either commercial feasibility or advisability. It may be impossible to maintain a furnace in continuous operation under the conditions necessitated by the production of such a slag. This matter has not yet been worked out.

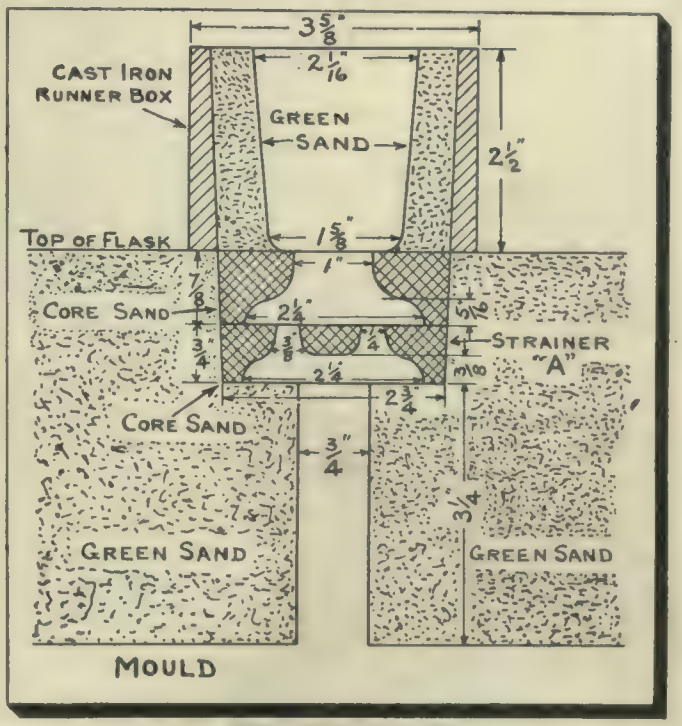
## A BRASS FOUNDRY KINK.

IT not infrequently happens in the best regulated brass foundries that a pot will "freeze" just before pouring, and the common practice of running this metal into a "pig" or "buttons" is not only wasteful but unnecessary. Small pieces of phosphor tin should be kept at a convenient place, easily accessible to the flowmen and should a pot freeze even after it has been skimmed, drop a piece of phosphor tin into it and stir to the bottom. The metal will immediately flow freely and the introduction of the phospor tin will not materially affect the mixture, but will, if anything, make the masting more fine grained, and clear. The quantity of phosphor tin required to produce the desired result will, of course, vary with conditions, but as a rule a piece of about 2 ozs. will "boil" 100 lbs. of metal.

## THE GILVEAR GATE.

THE skim gate herewith illustrated was devised after much experiment by Mr. T. H. Gilvear, Foundry Superintendent for the Berlin Machine Works, Ltd., Hamilton, Ont. It is made in two sections out of core sand; a third section, consisting of a cast-iron runner box suitably lined with green sand, being superimposed upon the other two. The lower section (A), known as the strainer, has ordinarily three holes in it for the metal to strain through. The size illustrated is used for castings averaging 50 lbs. in weight; but the gate may be made large enough, and with additional strainer holes to pour pieces even up to 400 lbs.

By the use of this gate experienced moulders can confidently count on 95 per cent. of good castings for machining. The dirt in the iron, particularly in the first few drops poured, cannot penetrate into the mould, it being thrust aside in the strainer by the clean and faster flowing iron that follows. In the Hamilton foundry of the Berlin Machine Works, some hundreds of these gates are now used daily; and in consequence, the reduction in the number and weight of bad castings has been almost phenomenal.




THE GILVEAR GATE.

**The Canada Steel Co., Ltd., Hamilton, Ont.**, are about to make extensive additions to their present plant at an estimated cost of about $75,000. The new building is to be 300 feet by 40 feet, and will accommodate four stands of 3-high mills and pinions. These will be used chiefly for rolling down billets and for rolling the high carbon reinforcing bars in which the firm specializes to a large extent. The shipping department has recently been enlarged by 110 feet and the stock shears have been placed there. The railroad siding for the new mill is already provided and building will commence immediately

# Trade Gossip.

**Mr. W. S. Atwood,** chief engineer of the Canadian Car & Foundry Co., Montreal, is now recovering from a nervous breakdown. He has been off duty for over three months.

**Stratford, Ont.**—An addition to plant is planned for the Canada Iron Corporation. Output of plant to be increased from 150 to 225 car wheels per day. Addition 75 x 75 reinforced concrete.

**Messrs. Royce, Ltd.,** Lumsden Building, Toronto, recently booked an order from the C.P.R., covering a 10-ton overhead travelling crane, for the Angus Shops, Montreal.

**Mr. C. J. Walker,** formerly buyer for Messrs. Lewis Bros., Montreal, has resigned his position to become Montreal manager for the Canadian Tungsten Lamp and the Ontario Lantern & Lamp Co.

**New Incorporation.** — The Standard Steel Construction Co., Ltd., Toronto, has been incorporated with a capital of $200,000. Messrs. A. and J. P. MacGregor and Mr. A. E. Wilson are provisional directors.

**Mr. Tinsley Waterhouse,** managing director of the Skefko Ball Bearing Co., Ltd., of London and Luton, England, is now in Canada and has arranged for the Canadian Fairbanks-Morse Co. to carry their lines in Canada.

**The Canadian Domestic Engineering Co., Ltd.,** have opened a branch office in Winnipeg, to handle its Western business. This company has a very large contract in hand for the new Parliament Buildings at Winnipeg, Manitoba.

**Burst Flywheel.**—By the bursting of a flywheel at the Manson Campbell factory, Chatham, on October 23, the engineer was seriously injured. The wheel crashed through the kiln wall, wrecking the engine room in its course and scattering fragments of machinery in all directions.

**The Linde Canadian Refrigeration Co., Ltd., Montreal,** have been appointed sole Canadian agents for Kynoch, Ltd., Birmingham, England, for the sale of their gas engines and gas producer plants. Hitherto there has been some difficulty with British gas plants on account of the difference between British coal and the hard American coal used on this side, but this has now been overcome, and Kynoch, Ltd., will manufacture a plant specially designed for use in Canada.

**Redcliff, Alta.**—A number of Medicine Hat business men have made arrangements to launch at Redcliff, Alta., the Redcliff Rolling Mills & Bolt Co., with a capital of $250,000. A practical man has gone East to purchase the machinery, and plans for the building are being prepared. It is expected that the plant will be in operation next spring. This company will turn out all kinds of angle, bar and channel iron, bolts, nuts, etc., and is expected to employ at least 75 men from the start.

**Baldwin Locomotive Works.**—The Baldwin Locomotive Works is running at a productive output close to the largest in its history. The company is now employing at the Philadelphia and Eddystone, Pa. plants more than 18,000 men, and has a payroll of $265,000 per week. The officials of the company declare that there is an abundance of work ahead for both plants.

**Messrs. Thos. Piggott & Co., Ltd.,** general engineers and contractors, of Birmingham, Eng., have recently supplied large quantities of steel pipes to Canadian order, among their contracts being an order from St. Boniface, Man., for 5,081 feet run steel piping, 24 in. diameter and ⅜ in. thick; and from Vancouver, an order for 7,000 feet run, 20 in. diameter, and 2,000 feet run 24 in. diameter, 5-16 in. thick. They have in hand a contract for Vancouver for 12,000 feet run of 24 in. diameter by 5-16 in. and 12,000 feet run of 24 in. diameter by ¼ in.

## ...ting on the Davis

...mum. The ba... wooden flasks, it being ... cut oval holes in the sic... date the finger wedges. b...

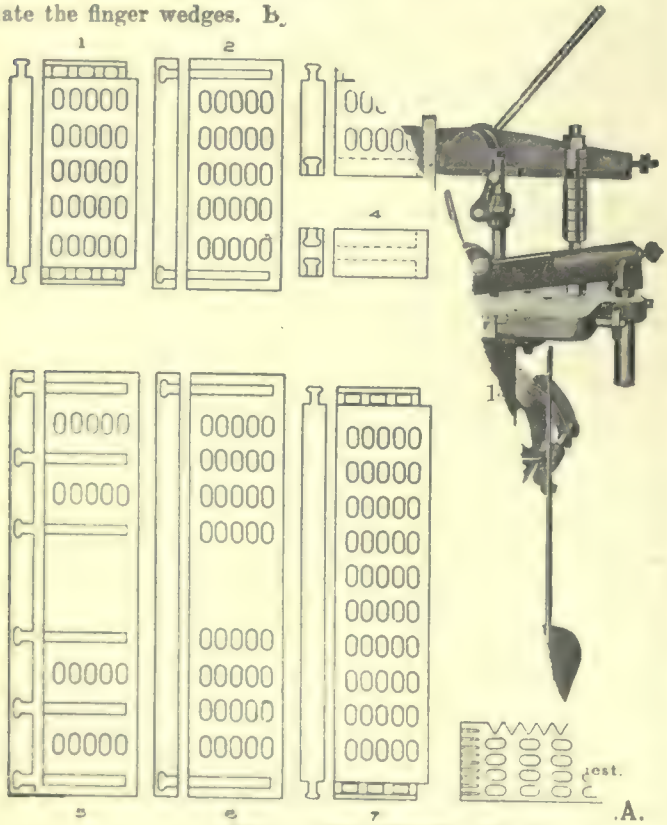


FIG. 1. THE TUOHY BOLTLESS FL... ...A.


# "Galt" Screws stand for Accuracy

A few reasons why Galt Screws are better.

1. They are made of the best material.
2. They are **absolutely concentric,** that is to say the threads and bodies of the screws have a common centre, therefore turn in straight and true.

***Send us your blue prints for prices on special screw machine products. We can make good delivery.***

**GALT MACHINE SCREW CO.,** LIMITED

**GALT, ONT.**

# Could This Happen to YOUR Factory?

There is one sure way of preventing it. One absolutely certain system of protection that will guard your plant both day and night, and **cut your insurance premiums in half while doing it.**

That way is to install **MANUFACTURERS' AUTOMATIC SPRINKLERS.**

The initial cost of installing our system of perfect protection from fire is not high, and the reduction in insurance premiums it will effect will soon pay for our complete equipment and cost of installation in your factory and office.

## Manufacturers' Automatic Sprinklers

Manufacturers' Automatic Sprinklers are to be found in some of the largest plants in the world, to say nothing of hundreds of smaller ones, and have many times proved their efficiency in extinguishing, before they could spread, fires which might have been disastrous.

The sprinkler heads fuse at a given temperature and discharge a deadly spray of water right into the heart of the fire, as soon as the air becomes one degree hotter than the given limit.

You cannot afford to risk your building, machinery and stock in this time of prosperity. Send for full information or for estimate—free, and free of obligation.

**General Fire Equipment Co., Ltd.**

**72 Queen Street East** **TORONTO, Canada**

# STEEL CASTINGS

Acid Open Hearth Steel for **Locomotive and Machinery Castings.**

Stock Process Steel for **Automobile and Light Castings of all descriptions.**

**Our plant will be in operation early in October.**

**(Annual Capacity, 12,000 tons.)**

***Let us figure on your requirements.***

**The Dominion Steel Castings Company, Limited**

**HAMILTON, ONTARIO**

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Vancouver, B.C.**—Fire recently destroyed the entire building and ruined practically all the machinery contained therein of the Vancouver brass foundry. Despite the strenuous efforts to check the fire, damage was done to the extent of $5,000. The concern was owned by Arthur J. Brunk.

**St. Johns, Nfld.**—The new machine shops being built by the Reid Nfld. Co., on the north side of the dry dock, are being fast rushed to completion. The concrete walls are finished, and a large staff of carpenters is now at work on the roof which will be finished in a few weeks hence.

**Eburne, B.C.**—Contracts have been awarded for the erection of the Dominion Safe Works Foundry. The building will measure 150 by 200 feet and will cost about $22,000, exclusive of machinery. The plans were drawn by Eward Sproat, and the chief contractors are Barwick Brothers.

**Welland, Ont.**—B. J. McCormick, Industrial Commission has completed arrangements for the location of a large steel industry to be known as the Standard Steel Construction Company, Limited. The concern will cover forty acres of ground; will employ 1,000 hands and will manufacture structural work for buildings and bridges, turning out about 4,000 tons per month.

**Vancouver, B.C.**—Work is progressing on the new plant of the Canadian Northwest Steel Co. at the foot of Georgia St. on the South side of False Creek and the company expects to have it in operation by Nov. 15. The site, which will be occupied by the shops and stock yard, is 150 x 800 ft. and will be enlarged to 1,000 ft. long. The main shop will be 100 x 400 ft. and will be of steel and timber construction. The entire investment will be about $300,000 and employment will be given to 100 men in the shops and 25 in the offices and drafting room. If it is found necessary to run a night shift the number of men employed will be increased about one-half. The plant will be able to fabricate about 1,000 tons of steel a month.

**Moose Jaw, Sask.**—The Morley Twine and Machinery Company, will shortly erect a plant here to meet the trade of the coming year. The buildings will occupy five acres of land and give employment to 100 persons. Harry Morley is secretary-treasurer of this concern.

**Montreal, Que.**—What will be the largest boiler in Canada is now in the course of installation at the Canada Sugar Refinery, at Point St. Charles, near here. The heater will be 20 feet high and will have all modern improvements. Its weight, not including the brick work, will be 77 1-5 tons and it will carry a pressure of 200 pounds per square inch. Its steam development power is equal to 1,000 horse power . There are to be 420 tubes, two Babcock and Wilcox chain grates, weighing 6 tons each. The cost of the boiler is $20,000.

**Watrous, Sask.**—Work has been commenced on the main building of the Farmer's Machine Company here. It will be 50 by 150 feet, and when this is completed, which will be about next spring, a good sized foundry with the latest machinery will be added. H. T. Helgeson is the manager.

**Owen Sound, Ont.**—The town recently passed a by-law authorizing the advance of $60,000 to the Canadian Malleable Iron Company. In return for the same, the said company will erect a foundry 500 by 80 feet with a site of 30 acres. Work on the construction of the plant will commence at once.

**Islington, Ont.**—The Dominion Bridge Co., Montreal, Que., will erect here storage sheds, assembling and steel bops and install powerful fitting cranes for extensive railway construction in and around Toronto.

### MUNICIPAL.

**Yorkton, Sask.**—By-laws authorizing the raising of $177,000 were recently endorsed by the ratepayers. The money is to be expended for various purposes, to construct overflow sewers, waterworks extension, and to extend electric plant, etc.

**Lindsay, Ont.**—The ratepayers have endorsed the by-law to raise $12,000 as a loan to the Fitzsimmons Auto Supply Company.

**Bowmanville, Ont.**—Two by-laws recently received the endorsement by the burgesses. They provide for the raising of $40,000 as cost of sewage and $111,000, the estimated cost of waterworks.

**Pembroke, Ont.**—A by-law which provides for the raising of $5,000 as a bonus to the Pembroke Box Factory recently received the endorsement of the ratepayers.

**Ayr, Ont.**—A by-law was passed by the burgesses here, authorizing the purchase of the electric light and power plant.

**Weyburn, Sask.**—The qualified ratepayers recently voted in favor of bonusing the Grand Trunk Pacific Railway.

**Stouffville, Ont.**—The ratepayers have endorsed the by-law to raise $35,000 as a bonus to a company for the manufacturing of furniture.

**Owen Sound, Ont.**—The by-law granting a loan of $60,000 to the Malleable Iron Works Company of Milwaukee was carried by the burgesses.

**Medicine Hat, Alta.**—The burgesses here recently showed themselves in favor of the by-law to raise $400,000 for a new water system and filtration plant.

**Winnipeg, Man.**—The result of the recent vote on money by-law by the ratepayers here was as follows:—Carried, to raise $500,000 for a site for exhibition; $750,000 for electric distribution; and $50,000 for public baths. The by-law to raise $1,800,000 for water supply was defeated.

**Biggar, Sask.**—The improvement by-law calling for the issue of debentures to the extent of $12,000 received the assent of the ratepayers.

**St. Thomas, Ont.**—The burgesses recently voted on the following by-laws:—to raise $15,000 as a loan to the Erie Iron Works for ten years; $30,000 as a loan to the St. Thomas Biscuit Company; $2,500 by way of a free site to Grave Vault Company. The by-law to give $2,000 via fixed assessment to the cold storage company was defeated.

**Ridgetown, Ont.**—The council recently endorsed the by-law to raise $35,000 upon debentures of above town for waterworks system.

**West Vancouver, B.C.**—The by-law to raise $100,000 to be used for the erection of wharves and to purchase a new ferry boat recently was endorsed by the ratepayers.

**Revelstoke, B.C.**—A by-law authorizing the raising of $10,000 to be expended in extending the local waterworks systems was recently endorsed by the ratepayers.

**Township of Hay, Ont.**—The council here recently met and passed a by-law to raise $18,000 by way of debentures, for the local telephone system.

**Point Grey, B.C.**—The following by-laws were recently passed by the ratepayers:—to raise $200,000 for waterworks system; $156,000 for school purposes; and $126,000 for road improvements.

**Estevan, Sask.**—The burgesses endorsed the by-law calling for the raising of $25,000 as cost of sites and warehouses for the Internation Harvester Company and Rumely Products Company.

**Prince Albert, Sask.**—The qualified voters recently endorsed the by-law calling for the raising of $125,000 to guarantee the bonds of the Great West Iron, Wood and Chemical Works, Limited.

**Bow Island, Alta.**—The ratepayers have voted in favor of raising money for the cost of a municipal gas well.

**Prescott, Ont.**—The by-law to raise $35,000 for the construction of a subway, etc., in connection with the proposed plan of the Grand Trunk Railway to locate terminals here, has received the endorsement of the ratepayers.

**Port Dover, Ont.**—The gas by-law, calling for the issue of debentures to cover expenses was defeated by the ratepayers recently.

**New Hamburg, Ont.**—The by-law to raise $40,000 as a loan to the Silversmiths, Company, Limited, received endorsement by the ratepayers.

**Windsor, Ont.**—It has been proposed that the city purchase new equipment for the ideal lighting plant, involving an expenditure of $20,000, and making necessary a by-law to raise this amount.

**Watrous, Sask.**—A by-law is about to be submitted to the burgesses whereby $10,000 is to be raised for waterworks expenditure.

**North Vancouver, B.C.**—It is proposed by the council to submit a by-law to the ratepayers for approval ,by which $150,000 may be raised on debentures to cover cost of public utilities improvements.

**West Vancouver, B.C.**—The by-law to raise $100,000 to be used for the erection of wharves and to purchase a new ferry boat recently was endorsed by the ratepayers.

**Hagersville, Alta.**—The burgesses recently endorsed the Hydro-Electric by-law, whereby an uncertain sum of money is to be raised.

**Pincher Creek, Alta.**—The by-law to raise $30,000 for a new municipal building has received the endorsement of the burgesses.

**Harriston, Ont.**—The ratepayers expressed themselves in favor of the raising of $11,000 for the purchase of, and in installing an electric light plant.

### ELECTRICAL.

**Belleville, Ont.**—There is now every possibility of this city obtaining an electric railway as proposed. Work is likely to commence in the early spring upon the line which will connect with the proposed line through Prince Edward district. When complete, this line will mean much to this city as a transporting medium for the men employed in Point Ann, one of the points to be touched and where 1,000 men are employed.

**Edmonton, Alta.**—Three hundred miles of electric railways, connecting Edmonton with numerous towns, coal mines and gravel deposits, grain and dairy districts, brick, concrete and other manufacturing plants in central Alberta, will be built by the Edmonton Interurban Railway company. George Barbey of Paris and Vancouver, head of a French syndicate, which has already invested more than $10,000,000 in Canada, is president. The company, incorporated under the laws of the province of Alberta in 1910 and reorganized in Edmonton on September 16, 1912, is financed by French and Canadian investors. The first unit of the system ,upon which grading work is in progress, will be from the city limits of Edmonton to St. Albert, six miles. Steel will be laid the coming winter and the line placed in operation for passengers, express and light freight traffic by June 1, 1913. The initial equipment will be 1260-passenger coaches and 50 freight and coal cars. The power house, to be erected at St. Albert, will be of a capacity to operate 28 miles of road. M. Kimpe, managing director of the company, has charge of the construction work.

**Peterborough, Ont.**—The ratepayers will have the opportunity of voting on a by-law to raise $88,000 for Hydro-Electric purposes, on January 1, 1913.

**Yorkton, Sask.**—By-laws authorizing the raising of $177,000 were recently endorsed by the ratepayers. The money is to be expended for various purposes, to construct overflow sewers, waterworks extension, and to extend electric plant, etc.

**Hanley, Sask.**—A by-law was recently passed by the ratepayers authorizing the council to issue debentures to raise cost of the erection and equipment of an electric plant.

**Campbellford, Ont.**—Campbellford, the power town on the Trent River, has commenced a publicity campaign and is issuing an illustrated pamphlet setting forth the advantages it has to offer manufacturers, capitalists and financiers in the way of cheap and abundant electric power at Healey Falls, Middle Falls and the various dams. The pamphlet says that the Seymour Power Company is using 5,000 horsepower, and the municipal plant 2,500 horsepower, leaving the large surplus of 40,000 horsepower to dispose of.

### GENERAL MANUFACTURING.

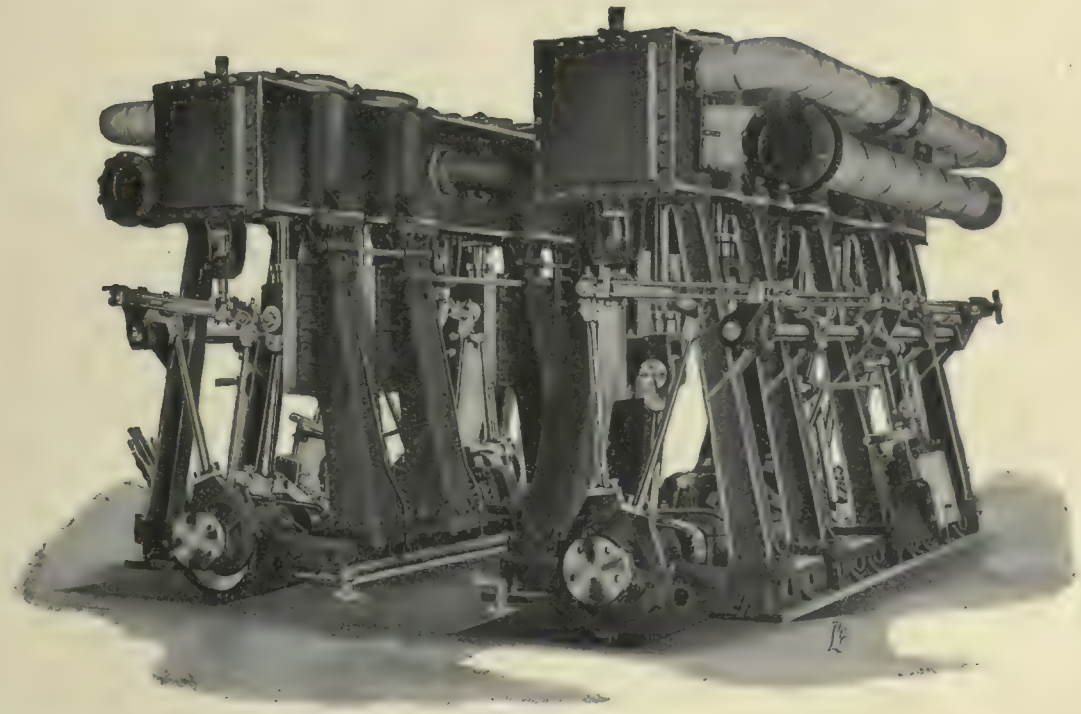
**Peterborough, Ont.**—The De Laval Separator Company are asking the city to make a loan of $19,000 to them to pay the cost of a site and the removal of the branch factories situated at St. John's and Montreal to this city. The building to be erected will be 112 by 400 feet. The new industry is under an obligation to make an initial outlay of $75,000 for buildings and equipment.

**Lindsay, Ont.**—The J. A. Fitzsimmons Company will commence building operations on their new factory at once. The new factory will be 126 by 43 feet, two storeys high, for which the National Concrete Company of Linsay will estimate.

**North Battleford, Sask.**—The Cordage Company of England, capitalized at eight million dollars, will instal a plant here employing seven hundred men.

**Galt, Ont.**—The fine three-storey building of the Galt Robe Company was gutted by fire which destroyed the building and stock contained therein, entailing a loss of $15,000. The

# ENGINES AND BOILERS



Marine Engine built for the R. & O. Nav. Co'ys Steamer "Rapids Prince."

We make Boilers of every kind for any service.

Engines, Pumping Machinery and heavy Plate work.

"Inglis" indicates the best in Quality, Design, and Workmanship.

*WRITE US FOR PARTICULARS*

**THE JOHN INGLIS COMPANY, Ltd.**

**Engineers and Boilermakers**

**14 Strachan Ave., Toronto, Canada**

# TENDERS
## for Motor and Pump

Sealed tenders will be received by the City of St. Boniface, Man., up till NOVEMBER 8TH, 1912, for the supply and erection of a variable speed motor and motor-driven pump capable of delivering either 1,000,000 or 1,500,000 imperial gallons per twenty-four hours.

The pump must be capable of delivering either of these quantities against a pressure of 65 lbs. (domestic pressure) and 100 lbs. (fire pressure).

The current supply in pump house is 550 volts, 3-phase, alternating.

Plans showing layout and available space may be obtained at the City Engineer's office.

Each tender must be accompanied by a marked cheque or cash equal to five per cent. of the amount of tender.

The lowest or any tender not necessarily accepted.

Tenders to be addressed to J. B. Cote, City Clerk, and marked "Tenders for Motor Driven Pump."

(Signed) J. B. COTE,
City Clerk.

## ADVERTISING MAN WANTED

Capable of taking charge of an important territory. Man with experience on trade or technical papers preferred. Successful specialty salesman would be considered. Splendid opportunity for right man.

Apply Manager,

**CANADIAN MACHINERY,**
**143 University Ave.,**
**Toronto.**

**Estate J. K. MacDONALD**

**General Machinist and Blacksmith, Locksmith, etc.**
**Contractors' Iron Work, Automobile Repairs, Chrome Nickel Steel Gears to order.**

**WRITE**
**D. A. MacDONALD, 318 Craig W., MONTREAL**

## Ernest Scott

145 Bleury St. ∴ MONTREAL

***Machinist and Tool Maker***

Dies for Sheet Metal Work. Stampings and Light Manufacturing

Special Machinery Designed and Made to Order.

## Superintendent Wanted

We desire to engage an experienced, energetic and ambitious superintendent for our stove and range factory and general grey iron foundry. An excellent opportunity for rapid advancement is offered to a really capable man. No "desk superintendent" need apply. We must have a superintendent who can cope successfully with all the troubles with the cupola, troubles with the mouldings, troubles everywhere. He must be absolutely fitted to take complete charge of the technical end of the business. A man conversant with soil pipe casting preferred. The plant is about to be erected in the Canadian Northwest. Write, stating full particulars, references and salary expected. Correspondence treated in strict confidence. The Great West Iron, Wood and Chemical Works, Limited, Prince Albert, Saskatchewan, Canada.

# TENDERS WANTED

FOR THE PURCHASE OF THE

# W. H. Salter Structural Steel Plant

**37 River Street, Toronto**

The undersigned administrator of the estate of W. H. Salter, deceased, requests tenders for the purchase of this business as a going concern, including the following assets:—

Real estate, consisting of 37 River Street, and factory and warehouse premises in rear, with roads, lanes, and siding rights over the G.T.R. switch to Don Esplanade. The buildings on this property consist of the dwelling house, 37 River Street, the three-storey warehouse building in rear; structural steel shop, office building and machine shop, with complete plant and equipment of same. Stock-in-trade of steel beams and other structural steel, office furniture and fixtures, book accounts and contracts in course of completion.

Also alternative tenders for the purchase of the above-mentioned assets, excluding the real estate, the purchaser taking a lease of the buildings used in connection with the steel plant.

Tenders will be received up to Saturday, the 9th day of November, 1912, at noon, when those received will be opened and considered.

Full particulars of the above-mentioned property and assets and terms of payment can be obtained from the undersigned administrator, which, however, shall not be bound to accept the highest or any tender.

Dated, 24th October, 1912.

**THE TORONTO GENERAL TRUSTS CORPORATION,**
Administrator of the estate of W. H. Salter (deceased).
By its solicitors herein.
**Cassels, Brock, Kelley & Falconbridge,**
Toronto General Trusts Bldg., Toronto.

# Classified Advertisements

## MACHINERY FOR SALE

MACHINERY FOR SALE—NEW AND SECOND-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

## WANTED

WANTED — EVERY POWER HOUSE IN Canada to remember that C. E. Shedrick, Craig Street West, Montreal, is still repairing mensuring instruments, both switch board and portable. Twenty-five years' experience in repairing all kinds and makes on the market. Integrating meters repaired, tested and sealed, and returned on quick time. (12y)

## BELTING, PACKING, ETC.

BELTING FOR SALE — 800,000 FEET OF best quality leather, rubber, hair and canvas belting, bought from bankrupt manufacturers at 25 to 75 per cent. less than the regular value. Also a large quantity of slightly used belting, piping, chains, rails, pulleys, hangers, cotton waste, etc., at very low prices. Send for catalogue, Imperial Belting & Supply Co., 5 Queen Street, Montreal.

BELTING, RUBBER, CANVAS AND LEAther, hose packing, blacksmith's and mill supplies at lowest price. N. Smith, 138 York Street, Toronto. (2tf)

## MANUFACTURING CENTRES

FREE FACTORY SITES — SEVEN RAILroads, deep water, Niagara power, natural gas, low taxation, abundant labor. Welland, Ontario. B. J. McCormick. (12y)

FOR SALE—BATH UNIVERSAL GRINDER with attachments for surface, cylindrical and internal grinding. In first-class shape, 3 ft. table, $275.00 f.o.b. Windsor Machine & Tool Works, Windsor, Ont.

FOR SALE—IDEAL PACKLESS VALVE CO. desire to dispose of their entire business, which is composed of over $9,000.00 worth of valve making machinery, tools and Patterns, also Letters Patent for a high-grade, simple and durable Packless Valve. Can prove to anyone interested, the value of patent, also that the construction is the most perfect of anything yet on the market, can give references to many well-known people who are now using our valve. Will send printed list of inventory upon application. IDEAL PACKLESS VALVE CO., Walkerville, Ont.

WANTED—EXPERIENCED ENGINEER TO take charge of refrigerating plant, capacity 250 tons. Must be thoroughly acquainted with engines, boilers and motors. Permanent position. Highest wages paid. Apply Box 120, Canadian Machinery, Toronto.

**JOHN J. GARTSHORE**
**58 Front St. W., Toronto**
**RAILS and SUPPLIES**
**New and Second-hand**
**For RAILWAYS, TRAMWAYS, Etc.**
**Old Material Bought and Sold.**

**ARMSTRONG BROS.**
**83 Richmond St. West, Toronto**
**Mfrs. of SPECIAL MACHINERY**
**Patents Perfected**
**GEAR CUTTING, TOOLS, DIES, ETC.**
**Ruching and Pleating Machinery.**

insurance carried is about $99,000. The cause of the fire is as yet unknown.

**Pembroke, Ont.**—A company known as the Pembroke Shooks Mills Company, Limited, has been organized with head office here. The above mentioned company is composed of Hamilton capitalists and is capitalized at $100,000. The question of a bonus by the town was referred to the citizens who expressed themselves in favor of so doing.

**St. Thomas, Ont.**—Increased business has forced the Nursery Shoe Company to contemplate an addition to their present building. The minor details of the additions are not made known yet.

**Battleford, Sask.**—The first shipment of machinery for the new brick and cement block business being established here is now on the ground, and comprises two brick machines and one machine for the manufacture of cement blocks. The business will be operated by Mr. Erinshaw, of Winnipeg, a competent brick man, and will be in operation within a few days. It is the intention of Messrs. Lobb & Clark to put in a much more extensive plant than they at first intended, and they will accordingly add greatly to the present equipment early next spring. Arrangements are being made by the firm to establish their planing mill business here in time to take care of next year's trade.

**Medicine Hat, Alta.**—It is announced that Messrs. Ouim and Boucher of the Wetaskiwin Bedding Company have decided to construct a factory here for the manufacture of iron beds, springs and gates. The contract between said gentlemen and city has been signed and plans have been drawn up, making possible an early start. It will be 150 by 50 feet, Two storeys high. Forty men will be employed.

**Ambo, Ont.**—The Canadian Explosives, Limited, is seeking exemption from taxes for ten years and fixed taxation to be $60,000 for the entire property. The above mentioned company is capitalized at $15,000,000, and has seven plants elsewhere. Its directors consist of Messrs. William McMaster, T. J. Drummond, J. H. Plummer, B. McLennan, and C. C. Ballantyne. It is estimated that 400 men will be employed in the factory.

**Forest, Ont.**—Recently a joint company has been formed, capitalized at $40,000 to assume control of the present plant of local basket company.

**Winnipeg, Man.**—A new company known hereafter as the Canadian Motor Company has been organized and is capitalized at $500,000. E. S. Sherwood is the managing director. The above company has acquired the business lately carried on under the title of the Fort Rouge garage.

**Paisley, Ont.**—The local pump works, known as the Paisley Pump Works were completely destroyed by fire which is supposed to have been started by lightning. The factory was owned by Mr. Wm. Rush, and was an old land mark in this vicinity.

**Calgary, Alta.**—Work will be commenced within a month on a paper factory in Calgary to cost $75,000. Coarse grades of paper and cardboard will be manufactured out of straw. This will be the only plant of the kind in Canada, although there are a number of similar factories in the United States. The company that will build the plant is controlled by a Vancouver syndicate. The factory, when in operation, will employ fifty men.

**Watrous, Sask.**—The management of the Co-operative Laundry Company have made arrangements for the erection of a plant at this point as well as at Regina and Saskatoon. This building will cost about $30,000.

**Welland, Ont.**—According to a report a concern taking the name of the Empire Cotton Mills, Limited, will establish a plant in this city to cost three million dollars. The directors' names have not as yet been made public.

**Toronto, Ont.**—The management of the Northern Electric Manufacturing Company have been granted a permit to erect a new factory on Bay Street at a cost of $75,000.

**Toronto, Ont.**—The management of the American Abel Company will make an addition to their plant on Queen Street of this city. Mr. F. C. Remely, of Laporte, Ind., U.S.A., will assume charge of the alterations.

**Montreal, P.Q.**—Messrs. Walter Baker Company, Ltd., have taken out a permit for the erection of an eight storey factory to cost $50,000.

**North Bay, Ont.**—The management of the Bogart Refrigerator Company have requested the town council to grant a free site of two acres, exemption from taxes, and a fixed water rate preparatory to their decision to erect a plant.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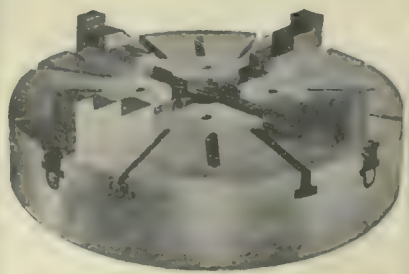

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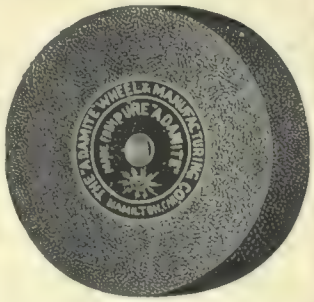

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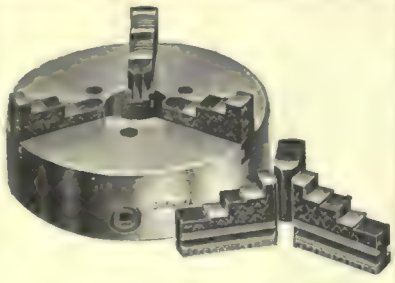

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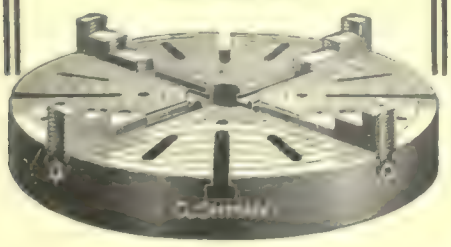

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### SAW AND PLANING MILL.

**Vancouver, B.C.**—A transfer was recently made of the Port Moody Saw Mill, tug boats, cut lumber, and timber limits belonging to the Emerson Lumber Company, Limited, to the National Finance Co., and the Thurston and Flavelle Lumber Company. The sale price was $500,000. The output of the mill is about 150,000 shingles per day. It also has a capacity of 75,000 feet of lumber per day.

**Calgary, Alta.**—A sash and door factory is about to be erected here which will employ fifty men. Already the foundation is being put in by Ed. Peterson, contractor, and within the next few weeks the building will be ready for the installation of the machinery.

**Norwood, Man.**—The factory of the Acme Sash and Door Company, which was recently organized, will be finished by November. The site contains two and a half acres which will be practically all taken up by buildings. At the rear a boiler room and machine shop will be erected, the machine shop having a shaving vault. The building will cost $20,000, and the plant when in operation will give work to 100 men.

**Vancouver, B.C.**—Fire, which originated by the emittance of sparks from the incinerator of the plant belonging to the Vancouver Lumber Company, spread until ultimately the company's dry kilns and 200,000 feet of lumber were consumed. The loss sustained is about $45,000, practically all covered by insurance.

**Coquitlam, B.C.**—What is claimed will be the largest mill of its kind is about to be built by the Canadian Western Lumber Company at Fraser Mills in the form of a saw mill having a capacity of 125,000 feet per day of ten hours duration and is to employ altogether about 1,000 men.

**Chatham, Ont.**—The planing mill here owned by William Drader was completely destroyed by fire a few days ago. The fire, which is said to have started in the engine room destroyed the whole contents of the building. The loss of which is not covered by insurance.

**Grand Rapids, Sask.**—What is known as the Demus-Canadian Lumber Company was recently organized here. The company is capitalized at $500,000 and owns tracts estimated to contain 800,000,000 feet of lumber. The said company will shortly erect a mill here to cost about $370,000.

**Toronto, Ont.**—Mr. Justice Neville to-day approved of the scheme of reconstruction for the Dominion Saw Mills and Lumber Company. This provides for voluntary liquidation of the company and the formation of a new concern, which will shortly issue $1,000,000 six per cent. debentures and half a million one-dollar shares.

**Fort Frances.**—The Shelvin-Clarke Lumber Company is building two mills with a total capacity of 100,000,000 feet of lumber a year. In the plants 550 men will be employed. The pay roll will be $35,000 at least a month.

### BUILDING NOTES.

**Victoria, B.C.**—The Hudson's Bay Company propose to erect at an early date a large store here. It will be modelled after Harrod's Stores in London, England, with all the facilities to meet the Canadian requirements.

**Toronto, Ont.**—Before a large assembly of University dignitaries and old time students the corner-stone of the splendid edifice of Knox College was laid by the Governor-General of Ontario recently. The building which is a fine example of architecural design will cost about $500,000.

**Niagara Falls, Ont.**—An addition is about to be made to the General Hospital which will cost about $300,000. The cost will be covered by the legacy left by Susan Thompson.

**Moose Jaw, Sask.**—Work has commenced on the building of the Saskatchewan Creamery Company. The whole plant will represent an outlay of $100,000. The building will be two storeys high, 60 by 100 feet and have full basement. Two fifty horse power boilers are to be installed. Electric power will be used, but steps have been taken to provide steam power in an emergency.

**Toronto, Ont.**—A twenty-nine roomed school is about to be started at Kew Beach and will cost about $150,000. This sum will be solicited from the Board of Education by the property committee.

**Edmonton, Alta.**—A new civic building is now under construction here, which is estimated to cost $225,000. The building is to be fire proof, the materials used being steel, concrete, brick, and terra cotta. Altogether the structure will cover 20,000 square feet. D. M. Jeffrers is the architect.

**Port Arthur, Ont.**—A new company has recently been formed in Port Arthur under the name of the "Port Arthur Housing Corporation, Limited," with a capital stock of $250,000, divided into $100 shares .

This company has been promoted for the purpose of overcoming the lack of suitable housing accommodation. Plans have been prepared of a three-storey apartment house, giving each family two bedrooms, a living room, kitchen, bathroom and pantry. It will be brick-veneered and well built, with iron fire escapes.

**Winnipeg, Man.**—The Lombard Building Co., Ltd., a concern recently formed to finance the project, will erect a fourteen storey office building to cost, with the property, in the neighborhood of $960,000, at Lombard and Rorie streets. It will have a frontage of 120 feet, a depth of 90 feet and a rental floor space of about 120,000 square feet. Work commences as soon as the specifications can be prepared and the contract awarded.

**Grimsby, Ont.**—Tenders are being called for the construction of a new post office here. It is to be 72 by 40 feet, with a tower 64 feet in height. It will be of red brick and two storeys high with a basement.

**North Vancouver, B.C.**—Work on the construction of the Grouse Mountain observatory, which will be erected by the government, will start within a year according to private advices received here from Ottawa. The announcement of its construction was only given out recently It is understood that Mr. T. S. H. Sherman, director of the Vancouver meteorological station, will have charge of the observatory. Plans are not drawn as yet, but these will include the erection of equipment which will equal any that can be found anywhere on the coast.

**Winnipeg, Man.**—A large addition to the General Hospital here is being made, involving an outlay of $625,000. The work, which was started a year ago, consists of building two wings. Each six storeys high, 64 feet wide and 160 feet long. When it is completed, which is expected will be next May, the entire institution will be able to provide for 550 patients.

### MISCELLANEOUS.

**Brantford, Ont.**—The Ontario Government has appointed the Canadian Domestic Engineering Company, Limited, of Montreal, as engineers for the heating, ventilating, etc., of the new Brantford Asylum for the blind.

**Winnipeg, Man.**—The Canadian Domestic Engineering Company have been appointed consulting engineers for the heating, plumbing, ventilating, electric works and central power house equipment of the new parliament buildings, Winnipeg, Manitoba, involving an expenditure for the buildings of opproximately $5,000,000, and for the engineering work of $800,000.

**Montreal, P.Q.**—Messrs. Heap and Partners (Canada), Limited, have secured a contract from the Board of Control at Ottawa, for three Rees Roturbo motor-driven pumps with a total capacity of 45,000,000 gallons per day.

**Point Grey, B.C.**—The municipality are calling for tenders for the supply of about 33 miles of steel pipe, to be received until December 2nd, 1912 . Particulars may be obtained at the office of the water superintendent, Municipal Hall, Kerrisdale (Vancouver), B.C. Ben. A. Cunliffe, clerk municipal council, Kerrisdale, B.C.

**Quebec, Quebec.**—According to advices from Quebec, the Government will build the proposed dry dock, which will be operated by the Shipping Federation. Probably it will be constructed on the south side of Levis. Mr. William Price is to be appointed chairman of the reorganized Harbor Board.

**Montreal, Que.**—The city of Montreal has awarded the contract to instal three vertical centrifugal pumps for handling the sewage from low level to high level to Drysdale & Co., Glasgow, for whom J. T. Farmer, Montreal, is Canadian agent. The pumps which will lift the sewage about 18 feet, are each of 27 cu. ft. per second capacity, and are operated by 80 H.P. 550 volt A. C. Bruce-Peebles motors. The motors are automatically controlled, being switched in and out by float arrangement; either one, two or all three pumps being capable of operation as required.

**Shawinigan Falls, Que.**—The Shawinigan Water and Power Company are installing a third generator set of 15,000 kw., at Shawinigan Falls. The generator is being built by the Canadian Westinghouse Co., at Hamilton, while the transformers will be supplied by the Canadian General Electric Co., and the water wheels by the I. P. Morris Co. It is expected that the unit will be running by February 1st, 1913.

**Chesterville, Ont.**—A by-law was submitted on October 25th, asking authorization to close a contract for light and power with the Ontario Hydro-Electric Power Commission.

**Cobalt, Ont.**—The Northern Ontario Light & Power Company is now reported to have absorbed the British Canadian Power Co., which generates some 10,000 horse-power on the Matabitchouan River. This completes the

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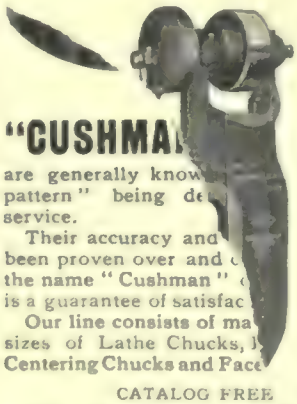

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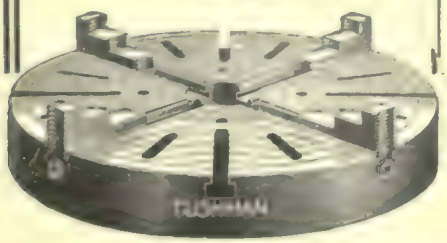

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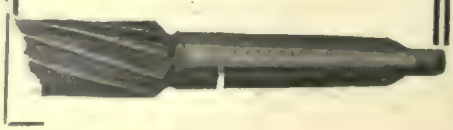

merging of the important companies in the Cobalt and Haileybury district.

**Port Alberni, B.C.**—Warden & Wilkins, Williams Bldg., Vancouver, engineers, have been instructed to prepare plans for an electric plant, also to estimate cost of plant and distribution system.

**St. John, N.B.**—St. John Railway Company have awarded contracts for 3 500 h.p. boilers to Babcock and Wilcox, Glasgow, and for large chimney, 150 ft. high, 7 ft. 6 in. inside diameter at top, to H. R. Heincke Co., Inc., New York. Contract for engine and generator not yet awarded.

**Summerland, B.C.**—Engineer Latimer has reported that extensions will cost $100,000 for waterworks and $50,000 for electric lighting system.

**Montreal, Que.**—The Cedar Rapids Power Company has asked the shareholders to meet on November 4th to authorize an increase in the capitalization from $10,000,000 to $15,000,000. It is also proposed to effect a change in the head office from St. Joseph de Soulanges to Montreal.

**The Prince Rupert Hydro-Electric Company** are installing two 750 H.P. Diesel units. These will be running very shortly, and will deliver power about the beginning of 1914. There is a total of 50,000 H.P. available, but it is not intended to provide more than 5,000 H.P. until the demand for power increases. When the hydraulic machinery is in operation the Diesel units will be used as standbys and auxiliaries. These engines were built on the Continent of Europe, and are being installed by the English firm of **Dick, Kerr & Company.** They are the largest units of this type at present in use in Canada.

### CATALOGUES RECEIVED.

**Jenkins Bros., Ltd., Montreal,** have issued the 1912 edition of their catalogue, and will be glad to mail the same free of charge to interested parties. The company are now manufacturing the well-known Jenkins Bros.' valves for superheated steam, as well as their regular line for standard, medium and extra heavy pressures. As in previous issues, packing pump valves, and other rubber specialties are also listed, and the catalogue, besides being most complete, is also very compact, measuring only 6¾x6¾ inches.

**The Coventry Chain Co., Ltd., Coventry, England,** whose Canadian representatives are **John Millen & Son, Ltd., Montreal, Toronto, etc.,** have mailed us copies of their catalogues D-2 and C-2. The former describes the firm's line of roller chains for automobile and general power transmission, while the latter deals with their "Noiseless" chains.

**The Murphy Iron Works, Detroit, Mich.,** have favored us with a copy of the twenty-fifth edition of their catalogue dealing with the Murphy Automatic Furnace. The merits of this popular furnace are too well known to render their enumeration necessary here. Suffice it to say that the catalogue is a most artistic production, such as is a real pleasure to peruse. The first twenty-four pages are used to explain and illustrate the construction and operation of the furnace, while the remaining forty pages are occupied by fine half-tone views of representative installations in the U.S.A., Canada, and elsewhere.

**Evans, Almirall & Co., New York City,** have mailed us an attractive booklet illustrating numerous large installations of the system of heating buildings for forced hot water circulation. Briefly stated, the system consists in heating the water by exhaust steam in closed heaters, and thereafter circulating it through the mains by centrifugal pumps.

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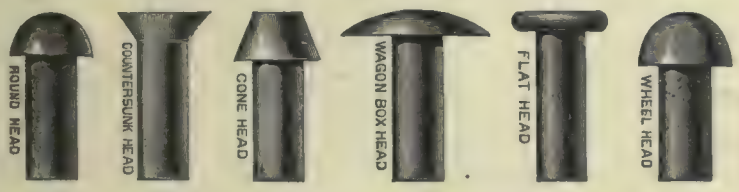


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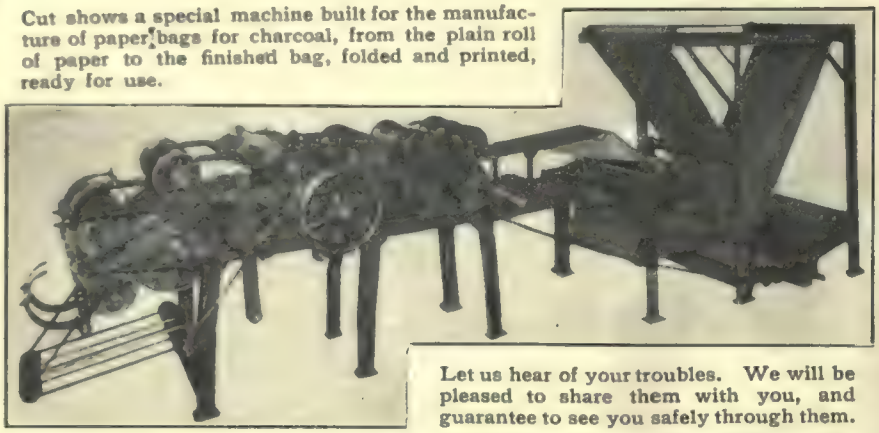

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AMERICAN MACHINISTS LIMITED

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**The Armstrong Bros. Tool Co., Chicago,** have issued Catalogue A-12 which is finely printed and illustrated. It forms a price list of this firm's well known line of drop-forged tool holders, wrenches, etc.

**The Vulcan Engineering Sales Co., Chicago,** have sent us a copy of their latest bulletin dealing with their smallest metal sawing machines—type IM. This is a small but powerful saw of large capacity and can be arranged for either a belt or motor drive.

**The Mott Sand Blast Mfg. Co., Chicago,** have mailed us a copy of Bulletin No. 115, dealing with this well known sand blast machine, the chief features of which are its great simplicity. All mechanism or working parts are located outside the tank, there being nothing inside the latter which will suffer through wear and tear and thus require renewing. Copies of this bulletin will be mailed to anyone interested.

**J. W. Paxson Co., Philadelphia,** has sent us Bulletin No. 28, which is recently off the press. This forms a handsome and very complete catalogue of sandblast machinery, and contains very full information on sandblasting for all purposes. The construction and operation of the various Paxson-Warren machines is clearly explained and illustrated, and taking it all round, the catalogue is one of the best that we have seen dealing with this subject.

**Charles H. Besly & Co., Chicago,** have issued for the benefit of users and prospective users of Besly disc grinders an interesting booklet combining the functions of catalogue and instruction book. The accuracy of the work done on a well-designed disc grinder equipped with tilting table, swiveling work holder, angle knees, etc., is of the highest class—a fact which is becoming daily more widely realized. On many lines of work the disc grinder will effect a considerable reduction in cost of output over a miller or planer and the Besly Company are always open to receive samples of castings, etc., on which they will carry out free, a production test with a view to learning the exact price for which they can be "machined" on a disc grinder. The booklet is divided up into seventeen sections and has a complete index at the end. One section explains the advantages of the new Besly pattern-maker's disc grinder with drum sanding attachment, which saves a large amount of skilled labor in the pattern shop.

**The Wright Manufacturing Co., Lisbon, Ohio,** have mailed us their latest catalogue of chain hoists. The Wright standard high-speed chain hoist is of the well known triplex type, the hoisting being through planetary gears cut from the solid. The main driving pinion and shaft are made of open hearth nickel carbon steel forgings and the hand wheels are malleable castings, instead of grey iron as is often the case. The load is held in any position by a positive automatic friction device but can be immediately lowered by a slight downward pull on the hand chain and is always under the control of the operator. These high speed hoists are made in sizes ranging from ½ ton to 20 tons. The company also makes a full line of screw hoists ranging from ¼ ton to 8 tons. In these, the worm is of steel, hardened and ground, while the worm wheel is of phosphor bronze. Each part of these hoists is manufactured with a high factor of safety and sold under a guarantee.

**The National Tube Co., Pittsburgh, Pa.,** have recently issued a second and revised edition of their handsome brochure, dealing with the manufacture of modern welded steel pipe. Excellent half tones and clearly written text help one to follow the complete process from the mining of the ore to the shipping of the tubes.

**W. T. Glover & Co., Ltd., Trafford Park, Manchester, Eng.,** have issued a leaflet setting forth the merits of a new type of protective cover for electric cables. This consists of braided whipcord, and is said to provide all the desired mechanical properties at a minimum cost, while its water-resisting finish renders it suitable for use in damp surroundings. This firm is represented in Canada by Royce, Ltd., Toronto.

**W. S. Rockwell Co., 50 Church St., New York,** who are well-known specialists in all types of furnace construction, have issued a new catalogue, No. 15, showing their rotary annealing and hardening furnaces for heat treatment of any small pieces of like dimensions in either brass, copper, steel or other metals.

**A. B. Ormsby, Ltd., Toronto, Ont.,** have forwarded a copy of their handsome loose-leaf catalogue, which describes the Ormsby-Lupton "Underwriter's" steel sash. This well-known sash has great durability and rigidity to withstand wind pressure. It affords a maximum of natural lighting and also efficient fire protection.

# New Foundry at the Waterous Engine Works, Brantford

By J. H. Williams.*

*It is just sixty-eight years since the foundation of what is now one of the leading firms of engineers and boilermakers in Canada was laid. The Waterous Engine Works Company at that time established themselves in a small way at Brantford, Ont., where they have remained ever since, gradually extending their plant and the scope of their operations until now their products are to be met with from one end of the Dominion to the other.*

IN ITS early days the Waterous Engine Works Company, Ltd., manufactured principally stoves and plows. These soon gave way to threshing machines and sawmills, to which were added, as time went on, boilers, steam engines, fire engines, heavy fire apparatus, brick machinery, wood pulp machinery, etc., etc. From its earliest inception, the business went briskly ahead. New buildings and equipment were added from time to time until more than half a city block was occupied by the plant, and still the business demanded extension. Being hemmed in on all sides, unable to extend further on their old site and feeling the handicap of being without railway sidings to their plant, the company finally had to face the question of rebuilding on larger premises either in Brantford or elsewhere.

The city, not wishing to lose a concern of this size, expressed its willingness to take the old site off the firm's hands and they were thus free to remove to their present location on South Market street, where plenty of room for extension and good railway connections were available. On the new site the large plant which they now occupy was erected in the year 1895. It covers an area of some twenty-five acres and gives employment to about 400 men.

*Associate Editor, Toronto.

### Recent Additions.

Since 1895 several additions have had to be made. The machine and boiler shops have been extended from time to time, until the old foundry was eventually found to be inadequate for turning out the tonnage of castings, necessary to keep the machine shop, etc., fully occupied. As a consequence, it was decided to build a new and up-to-date foundry having a greatly increased capacity.

### The New Foundry.

The cost of handling raw and finished material being always a large item of expense, the new foundry has been designed with special reference to inter-departmental transportation facilities, and equipment has been installed that permits of the handling of all material in the most economical manner. The new building is on the north side of the plant and runs parallel with the machine shop, the old foundry being at right angles and connecting the two departments. This old foundry is now being converted into a cleaning room, finished store room and pattern shop. In this way the rough castings will pass by consecutive stages and by the shortest possible route from molding floor to machine shop.

The new foundry, as may be seen from the illustrations presents a very light and airy appearance. It is 240 feet long by 110 feet wide with an extension, measuring 68 feet by 30 feet in the north-west corner, for the core ovens. The centre bay is 50 feet wide and there are two side bays 30 feet in width, that on the north side having a gallery overhead which accommodates the sand and coke storage bins, brass foundry, etc.

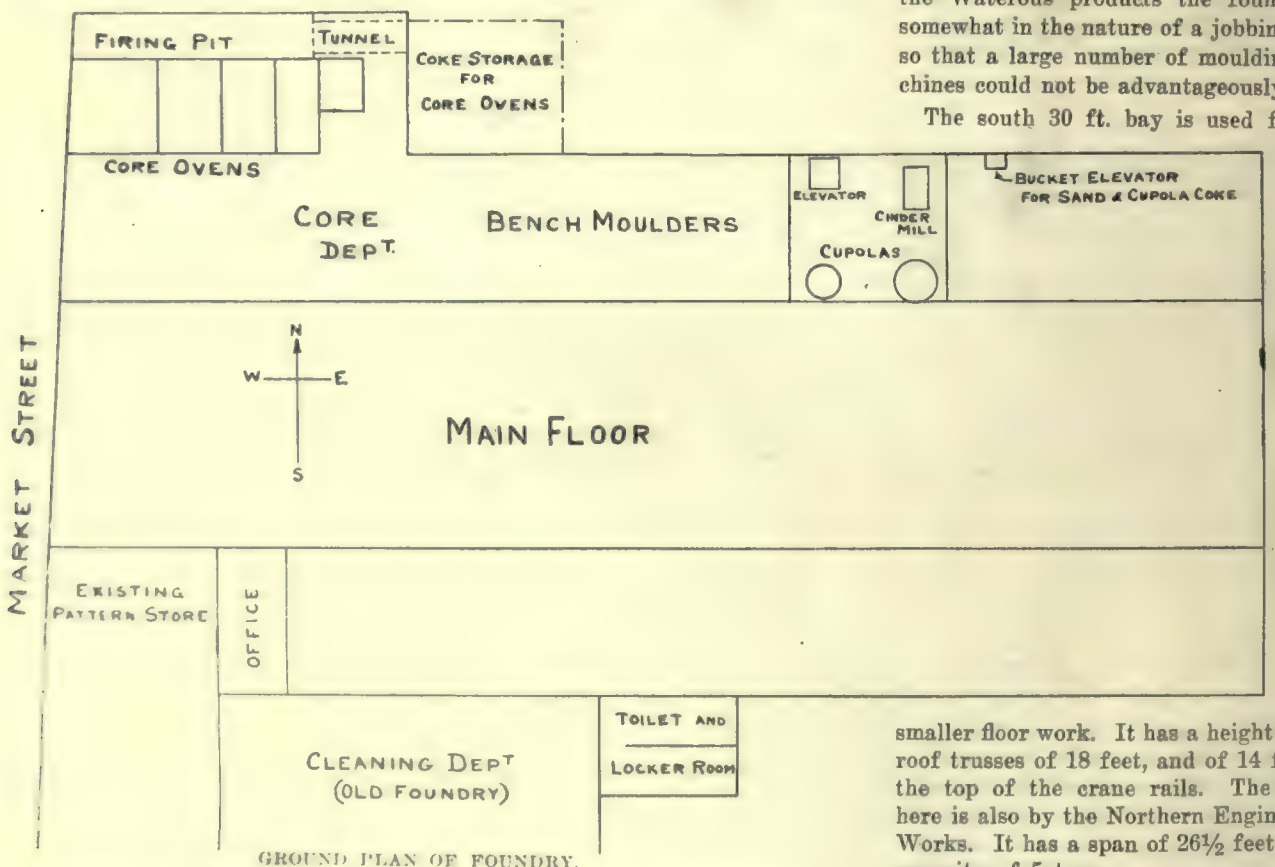
The structure is fire-proof throughout, with self-supporting steel frames and brick curtain walls. Particular care has been taken in the design of the build-

MAIN BAY OF FOUNDRY—LOOKING WEST.
A second cupola is now being installed. Note the arrangement of radiators on the columns.

ing to permit an abundance of natural light. A large proportion of the roof is glazed, and the windows occupy some 50 per cent. of the wall space.

INTERIOR OF THE OLD FOUNDRY.
This is now being converted into an up-to-date cleaning and storage department.

The foundry, with the exception of the cleaning department, is self contained, the molding, core making departments and core ovens being all under one roof. The main (50 ft.) bay is used for floor molding and the production of the heavier castings. The head room to the bottom chord of the roof truss is 30 ft., 9 in., the crane rails being 7 ft. 6 in. lower. This bay is served by a 15-ton electric traveling crane of the 3 motor type built by the Northern Engineering Works, Detroit, Mich. In addition to serving the full length of the main bay, this crane, by means of a 120 ft. extension, operates outside the building and handles the heavy iron flasks, etc., which are stored in the yard. The crane passes in and out of the building by special steel doors which are electrically operated. These of course are kept permanently open in summer.




GROUND PLAN OF FOUNDRY.

In addition to the 15-ton traveler the main floor is also served by jib cranes. Their arrangement is new and distinctly interesting. These jib cranes are not located permanently in one position, but can be readily transferred from one column to another. Each column is fitted with sockets strong enough to support the crane at its maximum load, and when any jib has finished its work at any particular column it is lifted from its sockets by the overhead traveler, and carried to another part of the shop. Thus, the capital cost of the jib cranes has been kept low and yet the service secured is practically equivalent to having a crane at every column.

The floor of the main bay, for a space 80 ft x 50 ft., is covered with a system of pits and grids for bolting down large flasks. The bars are spaced 4 feet apart and are 6 feet below floor level. Near the upper end of the bay there is a Mumford 10-inch jolt rammer, which is used both for moulds and also for large cores. Further mechanical moulding equipment includes two Pridmore roll-over draw-pattern machines, one of which takes a 56-in. x 24-in. flask and the other a 24 in. by 24 in. flask. There is also a pulley moulding machine which will turn out any size of pulley from 12 in. to 18 in. diameter. Owing to the varied nature of the Waterous products the foundry is somewhat in the nature of a jobbing shop so that a large number of moulding machines could not be advantageously used.

The south 30 ft. bay is used for the smaller floor work. It has a height to the roof trusses of 18 feet, and of 14 feet to the top of the crane rails. The crane here is also by the Northern Engineering Works. It has a span of 26½ feet and a capacity of 5 tons.

**The Core Room, Core Ovens, Etc.**

The north 30 ft. bay accommodates the core makers, bench molders, cupola room,

etc. The east end of this bay for a distance of 64 ft. is used for small floor work and is served by a 5-ton traveller. Next to this comes the cupola room to be referred to later. Its location may be seen on the plan—page 356.

VIEW OF FOUNDRY FROM GALLERY--LOOKING EAST.

The space between the cupola room and the core ovens is occupied by the bench moulders and core makers. Both departments have been allotted ample space and have an abundance of natural light. Heavy cores are rammed on the Mumford jolt rammer previously mentioned, and cylindrical cores from 3-8 in. up to 6 in. diameter are made by a Wadsworth core machine driven by a small motor attached to an adjacent column.

The core room has a concrete floor and is served by a 5-ton electric traveler which runs from the core ovens to the cupola room.

There are five core ovens, four being at right angles to the main bay and one small oven at right angles to the others. This small oven is 12 ft. x 10 ft. and is equipped with a small truck and has also a revolving shelf for drying small cores. The four larger ovens are all 20 feet long and vary from 8 ft. to 16 ft. in width. They are all equipped with steel roller doors, and can be fitted with shelves when necessary. For this purpose, cast iron blocks are built into the walls at intervals. These blocks are flush with the brickwork, and each has a hole into which a piece of wrought iron pipe can be inserted to form a support for a shelf. In each oven, the flue opening for the incoming heat is in the floor near the door, while the smoke outlet is at the opposite corner high up in the back wall; thus, a good circulation of heat is assured. The ovens are all fired by coke from a common pit on the north side. The coke is dumped from cars into a pit just outside the core oven annex, and is brought in to the firing pit in wheelbarrows through a short tunnel. Finished cores are stored on top of the core ovens where is located the motor-driven cutting and coning machine.

### The Gallery.

The gallery extends the full length of the north bay and is 20 feet above main floor level. It has a floor of reinforced concrete, 6 inches thick, supported on 15-inch I-beams, which rest on 33-inch steel girders carried by the shop columns. On the gallery are located the sand and coke storage bins, sand tempering machinery, cupola charging floor, and brass foundry.

The arrangements for automatically handling the sand and coke are very complete. These materials come in on a track parallel to the foundry, and are dumped into a pit below the track, whence they are carried by a bucket elevator to a smaller receiver above the gallery. This receiver is fitted with two chutes, one of which delivers to a large coke storage bin beside the cupolas, and the other to a 12-inch rubber belt conveyor which carries sand to a series of storage bins at the west end of the gallery.

The sand mixing machine is conveniently, situated near the bins and delivers the tempered sand to a small cone-shaped truck fitted with a bottom sliding door. The gallery floor is provided with a number of vertical chutes connecting with the main floor downstairs, so that when the above mentioned sand truck is rolled over the orifice of one of these chutes, the bottom sliding door is withdrawn and the sand falls through. The elevating and conveying machinery was built by the Waterous Engine Works Co. themselves, and is electrically operated, as is all the equipment throughout the foundry, except, of course, the pneumatic moulding machines, etc.

Pig iron and limestone are stored in the foundry yard and are brought up to the gallery floor, which, of course, forms the charging platform, by a platform elevator. The latter is raised by a motor-driven drum and is of the usual type. From there, the pig, etc., passes to a Fairbanks multiple beam platform scale on its way to the cupola.

The cupola room measures 32 ft. x 30 ft. It will eventually house two cupolas, though the second is not yet in place. The one already installed is a 72-inch

A CORNER OF THE BRASS FOUNDRY.

Collian, while the one about to be transferred from the old foundry is a 60-inch cupola made by the Waterous Engine Works Co. Blast is provided by a motor-driven Sirocco fan built by the American Blower Co.

The brass foundry occupies a space of 32x30 ft. at the east end of the gallery, and keeps four men steadily employed. A small jib crane in the middle of the shop serves the whole floor. There are two pit furnaces and a Kroeschell-Schwartz gyrating flame tilting furnace of 500 lbs. capacity. Natural gas is the fuel used. Brass castings up to 1,000 lbs. in weight are made, and also aluminum castings when required.

### General Remarks.

In addition to having excellent natural lighting, the ventilation is exceptionally good. As may be seen in the illustration on page 357, there are continuous ventilating doors on each side of the monitor roof over the main bay. These doors can be operated in sections of twelve from floor level by screws and rods fitted with universal joints. These doors are found to provide ideal ventilation. Artificial lighting is by flaming arc and tungsten lamps, the current for these and for driving the various motors throughout the plant being generated by the company in their own power house.

The foundry is heated by exhaust steam, the radiators being arranged below the windows and on many of the shop columns. In the latter case, the radiators sit snugly in the channel of the column and are flush with the flanges. This is clearly seen in the illustration on page 355. Fire protection is afforded by an efficient sprinkler system.

To render their identification the more easy the various pipe lines are painted distinctive colors. Thus the natural gas pipes are red; water pipes, white; and compressed air pipes, green.

Large crane ladles are dried by a coal fire in the usual way, but hand and bull ladles are dried out by natural gas. The output of the foundry is about 100 tons weekly, but the shop is not yet working at its full capacity owing to want of adequate cleaning facilities. However, the old foundry will soon be transformed into a thoroughly up-to-date cleaning room, fitted with square type exhaust tumblers, sand blast apparatus, and all necessary equipment. The south 80 ft. of the building will have an upper floor which will form a pattern shop.

The new extensions will practically double the foundry output of the Waterous Company; thus, not only enabling them to turn out their work in a more expeditious and economical manner, but at the same time allowing of a further extension in all other departments.

CONVEYOR BELT AND SAND S TORAGE BINS ON GALLERY.

The parties directly responsible for the operation of the new foundry are E. E. Brown, general superintendent, and T. R. Logan, foundry foreman. The design and construction of the shop were looked after by the E. G. M. Cape Co., general contractors, Montreal, Mr. T. A. Somerville having been in charge of the work.

## LARGE TESTING MACHINE.

A TESTING machine with a capacity up to 10,000,000 pounds, and reputed to be the largest in the world, has been installed in the laboratory of the Bureau of Standards at Pittsburg, Pa. The machine, according to details published in the Engineering Record, has been designed to test a 60 ft. column vertically, and it consists mainly of two large heads, each weighing approximately 30 tons, and four straining screws, 13½ in. diameter, placed upright at the corners of the machine. These screws support the upper head and enable it to be raised or lowered, to accommodate the length of column to be tested, by four nuts operated simultaneously through gearing. On the lower head are mounted the cylinder ram, and lower platen, and the pressure is applied to the ram by means of a three-plunger variable stroke pump, worked by a 15-h.p. motor, which forces oil into the cylinder.

## INDUSTRIAL ACCIDENTS.

ACCORDING to the record of industrial accidents compiled by the Department of Labor, that for the month of September shows that 89 workmen were killed and 419 injured; a total of 508. Compared with a record for August; this is an increase of one fatal and 114 non-fatal. The trades and industries in which the greatest number of accidents occurred were: steam railway service, in which there were 28 fatal and 123 non-fatal; metal trades, with 3 killed and 72 injured; mining. with 10 killed and 42 injured; and the building trades, with 10 killed and 33 injured.

## THE CANADIAN STEEL INDUSTRY.

IT is understood that as a result of the representations recently made to the government by the steel interests, a special commission will be appointed to investigate their claims. The steel men have placed in the hands of Hon. W. T. White, finance minister, an exhaustive factum, setting forth strong arguments in favor of increased protection, and have asked among other things for a special expert commission to probe the whole question. This they claim would result in increased protection, which would place them upon a more equal basis with foreign manufacturers. They assert that the steel industry should be dealt with separately, and by experts; that their demands are of vital importance and urgency, and should not be subjected to delay, which would be inevitable were they left to be dealt with by the proposed tariff commission. It is known that at least one or two of the Western Conservative Members of Parliament are not in favor of increasing the tariff on steel or anything else, and these would wish to be heard.

There are indications on all sides that the tariff will this session take rank second only in importance to the naval bill in the questions which are to come before the House.

## EDUCATION OF MANUAL WORKERS.

IN the course of his presidential address to the West of Scotland Iron and Steel Institute Mr. Walter Dixon referred to several points in connection with the education of manual workers. He stated that, over a somewhat extended period and a wide area, he had made inquiries among those who had collectively the control of about 200,000 men in the iron and steel and allied industries, with the following results:—

### Deductions From Experience.

(1)—It was the unanimous opinion that any book-learning outside the rudiments of the "three R's" was a matter outside the requirements of the avocation of 90 to 95 per cent. of the usual manual workers. In other words, the work these men were called upon to do would be as efficiently, as successfully, and as expeditiously performed if they had no school education whatever beyond the "three R's."

(2)—Of the remaining 5 to 10 per cent., among whom were to be found the charge-men, foremen, and other leaders, most would attain to the leading positions in which they found themselves through and by their own initiative, if three-quarters of the existing aids to learnings were abolished; and the plethora of educational facilities did not raise more than about 1 or 2 per cent. from the worker to the overseer stage. There was a further widespread opinion —it might almost be called a unanimous opinion—that as regards the 90 to 95 per cent., not only would the work be done equally well and efficiently were the workmen devoid of their present so-called "education," but it would be done more expeditiously and more satisfactorily, inasmuch as there would be less unreasonable restlessness and less unreasonable discontent, the inevitable result and the danger of a universal "little knowledge," causing the men to be a constant and easy natural prey of those who had the little more, though equally inadequate, knowledge.

(3)—A further unanimous opinion was that leaders, foremen, and overseers were in an overwhelming degree born, not made, and therefore that all forced school education beyond that already indicated—at least all forced technical education—was, for the majority whose lives must be devoted to manual labor, not necessary—indeed, perhaps harmful.

### The Aims of Education.

The president said that while he appreciated that many things might be said counter to or in modification of these conclusions, he put them forward as indicative of the opinions of the leaders of certain industries, and his investigations into other industries far removed from that of iron and steel assured him that in the main they had the approbation of those who controlled the majority of our industries. This being so, did it not call for a review of our educational methods, and might it not be possible to put our education on lines more suited to the conditions under which we lived? If it was a fact that education, as ordinarily understood, was a thing apart and outside of the avocation of most of our workmen, should not the education be designed in the main for the benefit and purposes of their recreative hours, giving up the idea that any material benefit was to be derived from technical education other than the best of all technical education — viz., that which men received in the course of their daily work? It was widely alleged that the effect of artificial forcing upon masses of partially-developed minds was largely, if not mainly, to spoil what would otherwise be good workmen, and to manufacture a half-efficient, half-developed, and constantly discontented class of aspirants to positions of responsibility and trust for which they were entirely unfitted.

### National Dependence on Industrial Workers.

He was not prepared to offer suggestions for change beyond saying that so long as the existence of any nation depended upon its industries there must be men who were prepared to do manual work, men who regarded such manual work as an honorable avocation, and not as slavery—a term which was now—largely, as he believed, owing to our educational methods—applied to many manual avocations. It must be recognized that the mechanical developments of the last half-century had done away in a large measure, and for ever, with the possibility of the interest which a man could once take in his daily work, inasmuch as few men now made anything, but only a very small portion of something. It must further, be recognized that, under the reign of industrial competition, the hours of labor were likely to be hours of stress, and that when a man had finished his labor it was only right that he should have hours of reasonable recreation.

It was with a view to making these hours of recreation worthy of the nation that he felt our educational methods might and would ultimately be altered. This time would the more quickly come when we ceased to lose sight of the fact that education so-called—either technical or otherwise—to which our educational enthusiasts of to-day would more or less exclusively devote so many of the earlier years of every man's life, was only one—and that by no means the most important—of the factors essential to every one of the men who could possibly rise above the purely manual worker. Of these other factors, an inborn common sense and natural level-headedness might be said to be the most important. While, therefore, many of the subjects — if needs be, all the subjects — which were taught in our schools at present might be continued, he thought the point of view and the object for which they were taught might be largely remodelled, and the subjects so treated that each student might in some way get that which was commensurate with his mental and relative physical status.

## ELECTRIC SMELTING OF CANADIAN ORES.

THAT the electric smelting of Canadian ores is a practical commercial possibility has been demonstrated, and will be so reported in an announcement now being prepared by the Mines Department. The report will cover results obtained with the 100-ton furnace installed at the Soo in 1906, and with the perfecting of the process in Sweden.

The announcement is of great importance to Canada, and especially Ontario. Hitherto the extensive iron deposits of Ontario have been scarcely touched because coal had to be imported, and the ore contains a high percentage of sulphur which could not be removed with blast furnaces.

## LIQUID FUEL.

AT the October meeting of the New York Railway Club, a paper dealing with liquid fuel was presented by W. N. Best. The author stated that liquid fuel is often used with burners that do not thoroughly atomise the oil and evenly distribute the heat throughout the firebox or the charging space of the furnace. A burner should really form a flame to fit the length and width of a furnace as evenly as a blanket covers a bed. It should be capable of atomising fuel of any gravity procurable in the open market without either clogging or carbonizing, no matter whether it be fuel oil of very light gravity or crude oil, oil tar or coal tar. A burner is not worthy of consideration unless it enables the operator to burn any liquid fuel, for no manufacturer should be limited to the purchase of one particular kind of oil.

The author went on to say that a burner should be of such construction that it could be adjusted to make a long narrow flame or a broad, fan-shaped blaze, and each burner should be thoroughly tested so that when it left the

shop where it was made, the manufacturer would know that it would fill the requirements for which it was furnished. A burner, having the oil orifice below the atomiser orifice and independent of it, renders efficient service because there was no liability of the oil solidifying or carbonising over the atomiser slot at the nose of the burner.

## NOISY SPUR GEARS.

IN an article entitled "Gear Data for Motor Applications," the author, Mr. C. W. Drake, points out that spur gears ordinarily begin to make a noticeable noise at pitchline speed of about 600 ft. per minute, but under average conditions may not become disagreeably noisy with pitchline speeds under 1,200 ft. per minute. The amount of noise allowable depends on the noise made by surrounding machinery, on the character of the workmen, and on the nature of the work in the vicinity. A noise that would be unnoticeable in a boiler shop might be exceedingly disagreeable in a shop that was otherwise comparatively quiet. Where noise is not a limiting feature, there is no limit to allowable pitch-line speeds, except the increased wear and depreciation of the motor, gears, and driven machine; but depreciation may become a very important factor with high pitch-line speeds, say, 2500 ft. per minute, or sometimes even less.

## CHILLED IRON CAR WHEELS.

ACCORDING to the report of the Interstate Commerce Commission there were in service on June 30, 1910, 2,133,531 freight cars, and as eight wheels are needed to equip a car, there were 17,068,248 wheels in service at that time under freight equipment alone. Ninety-five per cent. of these were chilled iron wheels, while the numbers used under passenger cars, locomotive tenders, and on private car lines run up into the hundreds of thousands.

The chilled iron car wheel is really composed of three parts—the hard tread, soft plates, and a soft hub. The tread, or running surface, is as hard as the hardest steel, and because of this hardness it becomes polished in service and thus reduces the friction between the wheel and the rail. The plates are soft, thus insuring the necessary structure to carry heavy loads and to resist temperature changes and the resultant stresses due to brake application. The hub is soft, so that the wheel may be easily machined for axle fit.

The Master Carbuilders' Association specifies three classes of wheels for cars of different capacities, 625 pound wheel for 60,000 pound cars, 675 pound wheel for 80,000 pound cars, and 725 pound wheel for 100,000 pound cars. As the capacities of the cars have increased, the weight of the wheels has increased, but not in the same proportion. For an increase in car capacity of 66 2-3 per cent., the weight of the wheel has increased only 16 per cent., while the increase in the weights of the axle and the car body are 58 and 43 per cent. respectively. The tendency of the railroads is to increase the capacity of the cars beyond 100,000 pounds, but while axles have been designed for 140,000 pound cars, no wheel has been specified for this service. The chilled iron car wheel makers are, however, placing in service wheels to carry this and even greater loads. Their use under tenders of 10,000 gallons capacity and 150,000 pounds ore cars shows that there is scarcely a limitation to their employment, and they are standard because of safety, economy, and adaptability.

### Service and Cost.

The important service that the chilled iron wheel is rendering is performed at a minimum cost. A chilled iron car wheel is sold in the market at an approximate differential of $3.50, and the net cost to the railroad is the difference between the selling price and the old wheel which is taken in part payment for the new one. These wheels are guaranteed for a certain period, and in case the wheel does not give the service for which it is guaranteed the loss comes on the manufacturer. Under some conditions of service the 625 pound wheel is guaranteed for six years' minimum service, the 675 pound for five years, and the 725 pound for four years. The average life, however, greatly exceeds these figures, approximately double the guaranteed service being secured from each of the three wheels. The cost per car based on a differential of $3.50 and an average life of 12 years is therefore approximately $2.33.

It is stated that 85 per cent. of the repairs to freight cars are due to shocks consequent on coupling, etc., thus damaging bolsters, draft gears, and other parts of the car. Analysis will show that the wheel expense is insignificant compared with the repairs for other parts of the car. If any other wheel is substituted for the standard chilled iron wheel it must be demonstrated by competitive tests that it is more economical per ton mile, that it is better adapted to the service for which it is intended, and that it is safer. It must be borne in mind that an added cost of $10 per wheel would involve the expenditure of $80 per car. The interest on this investment at 5 per cent., would be $4 per car per year, which is more than the renewal cost of the standard chilled iron car wheel.

## THE CANADIAN COAL OUTPUT.

NOVA SCOTIA and British Columbia will in future have to fight for supremacy in Canadian coal production. Nova Scotia, for many years, has led the way. In 1911, according to the figures of the Department of Mines at Ottawa, that province produced 6,994,000 tons with a value of $14,050,000. British Columbia was second, with over 2,000,000 tons, and a value of nearly $8,000,000. The prediction that the coal mines throughout British Columbia, and particularly on Vancouver Island, will be among the most important in the world, may not prove far wrong.

British Columbia already holds some notable records. Since 1836, for instance, it has produced over 34,000,000 tons of coal, with a value of $109,000,000. In the past ten years its production has exceeded 17,000,000 tons with a value of approximately $55,000,000. When the industry gets the capital necessary for its exploitation, the Pacific Coast Province will be setting records not to be easily surpassed.

### Coal Imports.

Despite the large coal resources known to exist in Canada, production in recent years has been only about half the estimated home consumption. The remainder of our requirements are supplied by imports, chiefly from the United States. In 1911, for instance, Canada imported coal classified as follows:

| Coal | Tons | Value |
|---|---|---|
| Bituminous ... | 8,905,815 | $18,407,603 |
| Slack .. .. .. | 1,632,500 | 2,090,796 |
| Anthracite .. . | 4,020,577 | 18,794,192 |
| Total .. | 14,558,892 | $39,292,591 |

No question as to the existence of markets can be raised. The demand is rapidly increasing as our population grows, and our industrial life quickens, yet one trouble in a new country which has unlimited natural resources and opportunities, is that certain industries must wait for men and money. The coal industry of the Dominion has been satisfied to a certain extent with both development factors, but can well absorb legitimately many millions of capital and much labor to bring to the surface good coal in almost countless tons.

### Statistical Data.

The following figures for several years, taken at random from official returns, show the distribution of British Columbia's coal production in tons.

| Year | Production | Home consumption | Sold for export |
|---|---|---|---|
| 1900 .. | 1,599,851 | 685,667 | 914,184 |
| 1905 .. | 1,737,010 | 1,089,667 | 647,343 |
| 1909 .. | 2,326,899 | 1,585,232 | 741,667 |

Last year 573,888 tons of British Columbia's coal was exported to the United States, and 38,808 tons to other countries.

# Some Recent Developments at the C.P.R. Shops, Winnipeg

By C. T. R.

*This article deals with the manner in which the total production of these large railroad shops was recently greatly increased. The re-arrangement of the locomotive shop was of a radical nature, the boiler work having been entirely removed to a new shop, and the transfer table placed outside. The lay-out of the machine shop was also entirely revised with very beneficial results.*

SOME extensive changes and additions were recently made in the layout of the Winnipeg shops of the Canadian Pacific Railway. These embodied a new boiler shop in a building independent of the main locomotive shop, a new steam shovel shop, which incidentally made the tender shop larger, a new upholstery shop and wings to the car shop, and several smaller buildings. As a result of the removal of these departments into new quarters, an almost total rearrangement became necessary.

Before these changes, the locomotive transfer table, which is to be seen in plan along the north side of the locomotive shop, was inside the shop in the centre section at the east end. The erecting department now extends the whole length of the north side of the shop, having formerly occupied both sides of the east end. The old arrangement had its advantages, in that the erecting pits were on both sides of the transfer table, the arrangement giving the largest number of pit entrances for the least movement of the table. Its disadvantages were that it occupied a large amount of valuable space and did not allow of the expansion which the increase of power has required the shop to handle. The pits at the extreme end of the shop were, and are still, used generally for light repairs and for final work before despatching of repaired engines. Unwheeling is done on the 100-ton stationary overhead crane in the centre of the shop and from this track all the other shops are laid out. The erecting shop is served by two overhead travelling cranes of 20 tons capacity each and also by 25 ft. swing jib cranes of 1½ tons capacity; one jib crane being placed between every two pits. These jib cranes handle all front end work and relieve the overhead travellers to a great extent. The whole shop is served by a system of industrial tracks, its main aisle running parallel to the erecting shop. There are two tracks on this aisle, one up and the other down, with feed lines connecting at right angles at various points to facilitate the handling of the work.

VIEW IN THE YARD—C.P.R. SHOPS, WINNIPEG.

### Erecting Shop Tool Stores, etc.

A feature introduced in the erecting shop is a tool store, with a desk inside, for each gang charge hand. On one side of each tool store is a lathe and an emery wheel, while on the other side is a small radial drill, the countershaft being arranged on the top of the store. These machines handle the work of the gang as required. The departments that are an adjunct to the erecting shop, namely, the jacket gang, pipefitters and carpenters, are located in direct contact with the erecting shop, so that material transfer is as short as possible. Another new feature of the main shop is the centering of the blacksmiths in the locomotive shop. All repair to motion, springs, brake work, etc., except the very heavy work, is brought to this point, where it is handled more expeditiously than was before possible.

GENERAL PANORAMIC VIEW OF THE C.P.R. SHOPS, WINNIPEG.

### New Boiler Shop.

The new boiler shop is located towards the east end of the locomotive shop on the north side of the transfer pit. It is 286 ft. long by 120 ft. wide and has ten pits that are in direct communication with the transfer table. The boiler shop has two bays, each 60 ft. wide, one bay being divided into pit tracks and the other forming the manufacturing floor. The south bay—(that having pits)—is served by a 10-ton overhead traveller, while the north side (manufacturing floor) is served by a 20-ton overhead traveller, both travellers running the whole length of the shop. Engines coming into the shop solely for boiler repairs are run to one of the pits, where they can be operated on without taking up erecting shop space. There are three pit tracks running across into the manufacturing floor. These are used to make heavy lifts on or off an engine with the 20-ton crane. At the east end of the shop is the hydraulic riveter, which is served by a transverse overhead traveller of 20 tons capacity. This traveller also has an auxiliary 5-ton hoist for use on light work. The transverse runway is set high above the shop runway so that a boiler may be suspended on end for riveting. The relative heights of crane runways are as follows: 10-ton crane, 20 ft. high; 20-ton crane, 30 ft. high; and 20-ton tower crane, 42 ft. high.

A complete hydraulic plant is in operation and a pressure of 2,000 pounds per square inch is used to operate the hydraulic punch and shears, hydraulic riveter, hydraulic flange press and hydraulic superheater tube swage; these machines being used for the heaviest class of work. The other machines are arranged with motor drives, individually or in groups according to location. At the extreme west end of the shop is the tube department, the north side of which is employed exclusively on small boiler flues, while the south side handles superheater flues. Directly outside the shop, as will be seen in general plan, are the tube storage tracks and house. A small transfer turntable is used to handle trucks containing tubes in and out these tracks, the whole forming a complete and expeditious method of handling tubes without in any way interfering with the progress in the shop.

The entire shop is well covered with individual jib cranes, so that waiting for crane service is reduced to a minimum The large flange furnace, all tube furnaces and rivet furnaces burn fuel oil. The shop is piped with acetylene gas for use in connection with oxy-acetylene welding and cutting outfits.

### Boiler Shop Tool Store.

The tool room is centrally located on the north wall and is arranged with a view to quick handling of tools. A check system is in vogue by which an accurate tab is kept on tools. Checks received are hung over the box taken from, and all boxes are labelled with their contents. Tools are always turned in overnight and checks returned. Sufficient racks are provided for everything, and every-

SOME OFFICIALS OF THE MOTIVE POWER AND CAR DEPARTMENTS, C. P. R., WINNIPEG.

1. C. H. Temple, Supt. of Motive Power. 2. W. E. Woodhouse, Asst. Supt. of Motive Power. 3. G. H. Eaton, Asst. M.C.B. 4. R. A. Pyne, Supt. of Shops. 5. G. Humphries, Chief Clerk to S.M.P. 6. R. R. Nelld, Gen'l Loco. Foreman. 7. T. G. Armstrong, Gen'l Car Foreman. 8. E. T. Spidy, Asst. to Gen'l Loco. Foreman. 9. H. S. Hood, Schedule Inspector. 10. J. F. French, Chief Clerk to Supt. of Shops. 11. G. Powles, Foreman Erecting Shop. 12. S. J. Pentland, Foreman Machine Shop. 13. W. Bathie, Asst. Foreman Machine Shop. 14. W. Scott, Asst. Foreman Machine Shop. 15. T. W. Lowe, Gen'l Boiler Inspector. 16. J. Gollah, Foreman Boiler Shop. 17. T. Hinds, Asst. Foreman Boiler Shop. 18. R. Wilkinson, Foreman, Tube Shop. 19. W. Lowe, Foreman, Tender Shop. 20. J. Eddy, Foreman, Iron [illegible]. 21. W. Shields, Foreman, Blacksmith Shop. 22. J. McCallum, Steam Shovel Inspector. 23. R. Turner, Shop Engineer. 24. R. Quinn, Foreman of Road Material. 25. H. Sloan, Foreman, Pattern Shop. 26. H. Patton, Chief Engineer, Power House. 27. C. H. [illegible] Store Order Foreman. 28. R. H. Hart, Foreman, Electrical Department. 29. A. Martin, Foreman Repair Track. 30. J. Ritchie, Foreman Coach Shop. 31. H. Osborne, Foreman, Car Shop. 32. G. Lockhart, Foreman, Planing Mill. 33. A. Gamble, Foreman, Coach Paint Shop.

thing is in its place. The foreman's office is located next to the tool room and a men's lavatory on the opposite side of the latter; the whole being housed in a brick lean-to against the main building.

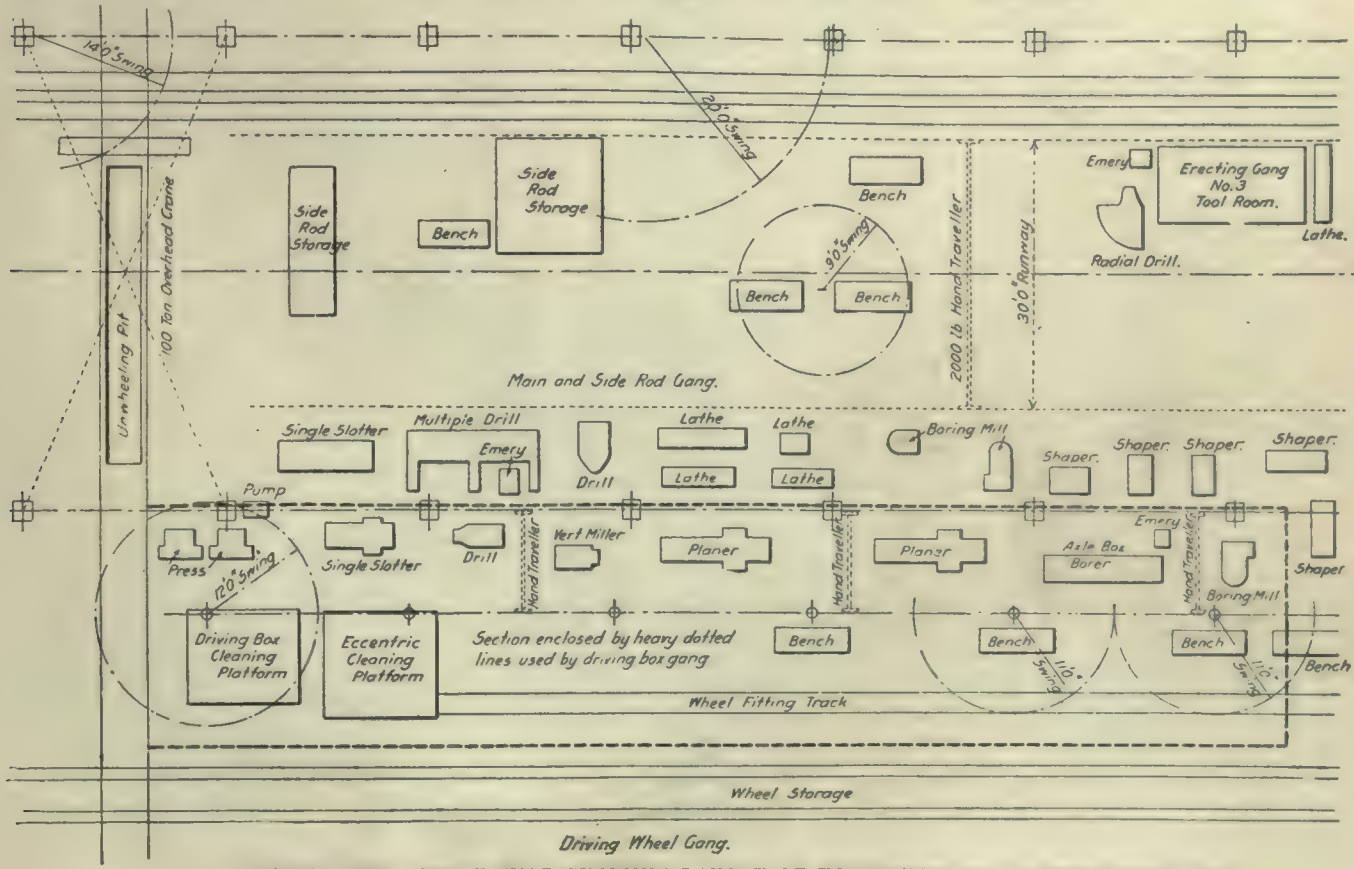
**Locomotive Machine Shop.**

The machine shop also underwent considerable change and all gangs were rearranged to the best advantage. More machinery was added and some of the older machines were discarded. The machine shop now covers an area of 26,000 square feet, which is about 20 per cent. more than previously occupied. The several gangs are placed in the most suitable position for their various classes of work and for the expeditious delivery of parts from and to the engines. Thus, the driving box gang is located where the boxes can be operated on close to where they are stripped from the wheels. The arrangement of the machines in this department is shown on this page. The wheel gang is located directly at the end of the unwheeling track, which leads directly into the tire house where tires are removed and replaced. All other machinery is arranged in the order of the subsequent operations, so that each job will have the shortest and least number of moves. The rod gang is located directly facing the erecting shop and delivers finished material to each engine at the pit. The general manufacturing gang for the stores is located at the extreme end, where it least interferes with progress of locomotive work. Two 7½-ton overhead travellers serve this shop for heavy traffic.

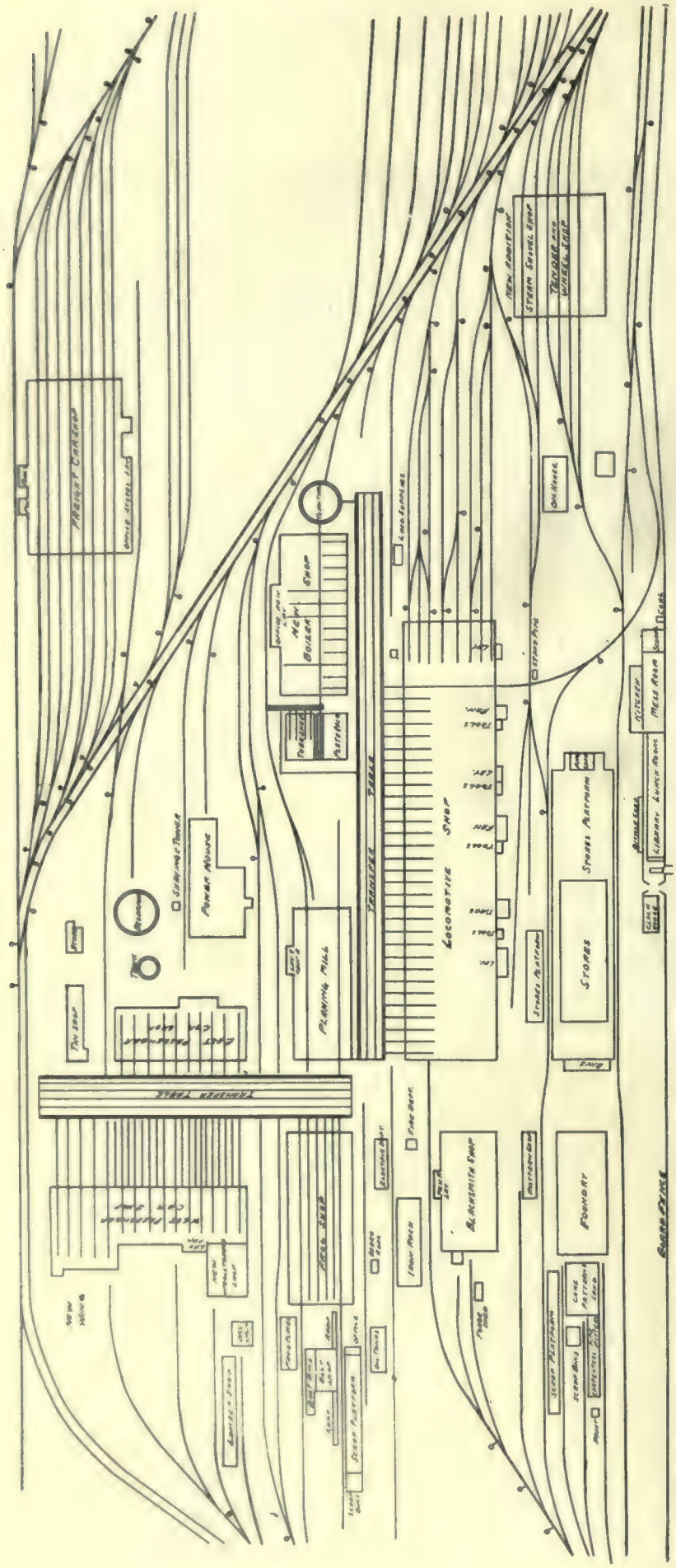
The machine shop office is located in a central position on the south wall. The tool stores and petty stores are in practically the centre of the machine shop, where they are most convenient for everybody. Directly by the side of the tool store is the toolmakers' department, where all repairs to tools, air motors, etc., are made, and new taps, cutters, jigs, etc., are manufactured. As the foregoing shows, the locomotive department has been changed considerably and the output of the shop much increased. The locomotive shop is 792 ft. long and 163 ft. wide, while the transfer table outside the shop traverses a distance of 1,040 ft. All other departments of the works were equipped with extra machinery at the same time, the whole of which has combined to produce the desired result of increased efficiency and output.

INTERIOR OF NEW BOILER SHOP.

On page 362 is seen an interesting group photograph of the chief officials and foremen of the motive power and car departments.




SECTION OF MACHINE SHOP SHOWING LAYOUT OF EQUIPMENT FOR DRIVING BOX GANG.




GENERAL LAYOUT OF THE C.P.R. SHOPS AND YARD, WINNIPEG, MANITOBA.

## THE EASTERN CAR CO. PLANT.

WORK on the plant of the Eastern Car Co. at New Glasgow, N.S., is progressing satisfactorily under the able supervision of H. H. Lane, of Detroit, a recognized expert with large experience in the designing, construction and operation of car building plants. Mr. Lane has done much of this kind of work for the American Car and Foundry Co., and he recently rebuilt the car plant at Michigan City for the Haskell & Barker Co.

The Eastern Car Company will have the benefit of four important factors, in addition to an absolutely modern plant. These are, that the works are close to fuel supplies, raw material is at its very doors, Pictou County has a splendid quality of labor and the location gives economical means of reaching the market. The Nova Scotia Steel and Coal Co.'s works, adjoining, obviate the necessity for carrying large stocks of steel, everything of this kind being available as required. The East River is being deepened to 34 feet and stocks of Southern pine, pig iron and other heavy material will be deliverable by ocean-going steamers. The Nova Scotia Steel and Coal Co. own large areas of timber lands and that company's mills, connected by the I. C. R. with the Eastern Car Co.'s plant, ensure a ready supply of local timber and wood. The ability to secure freight, so that the new cars can be sent loaded to Montreal and the West is an important matter. A large part of the output can be loaded at the works of the "Scotia" Company, and instead of paying freight for the shipment of empty cars, an allowance will be obtainable from the I. C. R. for their use with a load.

## RECORD STEEL OUTPUT.

THE October output figures of the Dominion Iron & Steel Company just issued show the month to have been the most successful yet experiencel in its history. The figures are as follows:

Pig iron, 31,090 tons; ingots, 29,975 tons; blooms, 27,880 tons; rails, 15,656 tons; rods, 8,868 tons; coke, 50,540 tons.

The standard records in the pig iron, bloom, rod and coke departments were smashed, as well as those in the sulphate ammonia, wire and nail departments. The exact figures for the last three are not available at the moment of going to press.

The recent blowing in of the new blast furnace, bringing the number up to five, is given as the reason for this splendid output. A sixty blast furnace is now in the process of construction.

# The Twin Cities of Fort William and Port Arthur, Ont.

By J. H. Williams

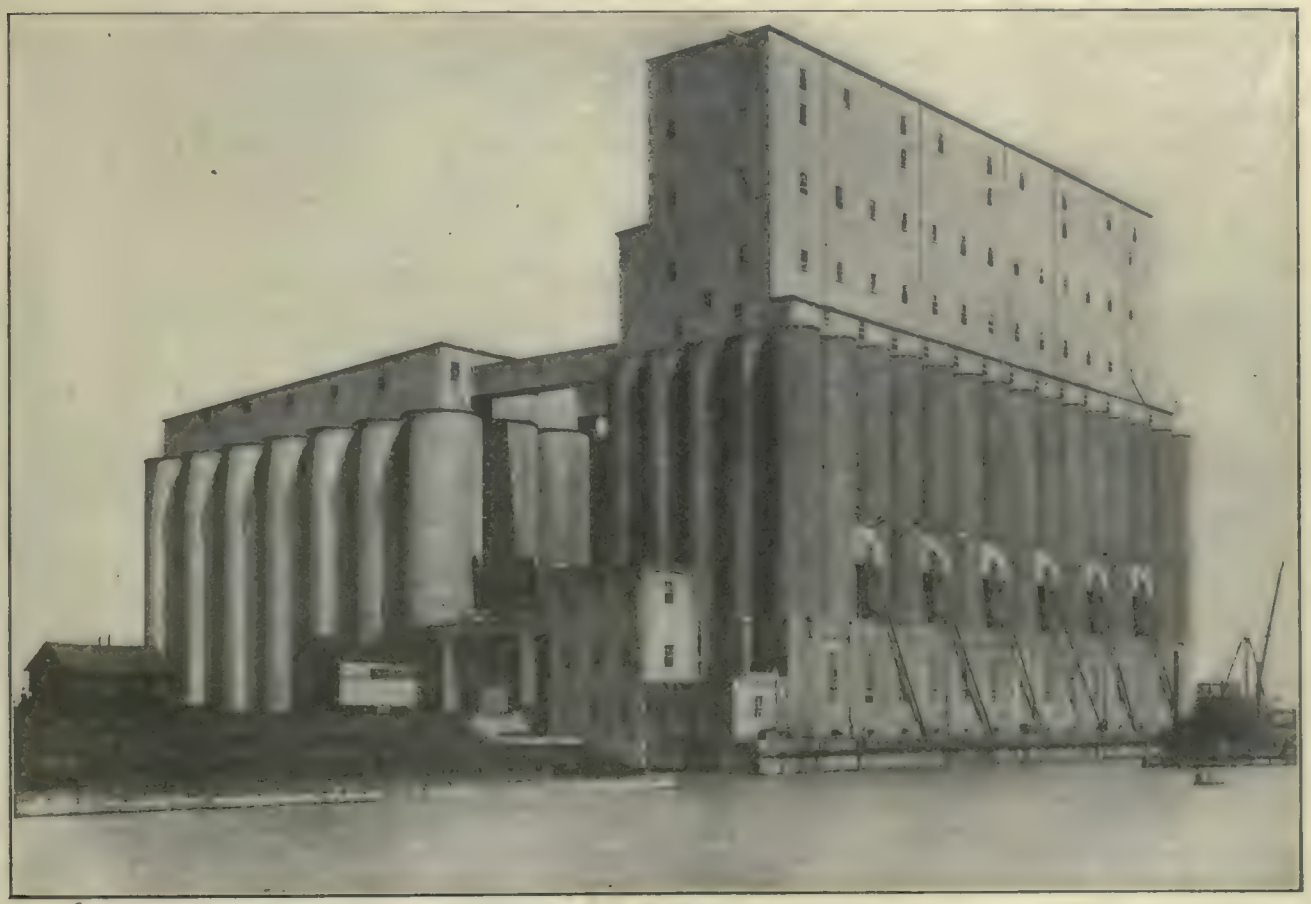
*The future of these two ports is absolutely assured. However enterprising railroads may be, and however many of them are built from East to West, Thunder Bay on Lake Superior must always be the head of a vast navigation; and water transport, whatever be the inventions of the remote future, can scarcely lose all its advantages.*

IN spite of their comparatively isolated location, far from any other large centre of population, the two cities of Fort William and Port Arthur have of late years gone ahead by leaps and bounds in a manner comparable to that of the most flourishing cities of the Far West. With a combined population of some 37,000, and an unsurpassed situation as regards water borne traffic, the industrial outlook for the twin ports is of the brightest, not only on account of their advantageous position at the head of the Great Lakes, but also because they are the bulk-breaking points for both eastbound and westbound shipments.

Fort William enjoys quite a respectable antiquity, having been founded in the year 1800. In those early days it was the chief trading station of the great North-Western Fur Company of Montreal, and life there would seem to have been sufficiently interesting. In the words of Mr. A. G. Bradley, the well-known writer on Canadian subjects: "Fort William was built in 1800 and in and around its walls gathered in their hundreds the Indians and half-breeds of the West, with their skins and peltries. It was strongly fortified, and was occupied by quite a garrison of the company's employes. Dr. Bryce, who has had access to their old journals, quotes freely from them in his memoir of the Hudson's Bay Company, and we are told of the wild revels that at Christmas and other festive seasons used to transform partners, clerks and the whole bureaucracy of this remote settlement into uproarious schoolboys. In the great dining hall, sixty feet long, and hung with pictures of the Nabobs of this North-Western wilderness, liquor flowed like water, and the revellers, seated in a long row, one behind the other on the floor, using tongs, shovels and brooms as imaginary paddles, ran imaginary rapids, and shouted the boat songs of the woods, while Indians, half-breeds, and coureurs-de-bois looked on in wonder and admiration."

Fort William retains no trace of its ancient character. Where schooners used to lie awaiting their load of furs great steamships now receive their burdens of wheat from rows of the largest elevators in North America. Port Arthur is six miles distant from Fort William and straggles in picturesque fashion up a dry hillside on which are built many fine residences. The view over Thunder Bay is very fine, and as the city faces to the east, the early riser is frequently rewarded by a glorious sunrise.

It will perhaps be best to treat the two cities separately; and since it has considerably the larger population we will commence with Fort William.



Grand Trunk Pacific Elevator, Fort William. This is the largest single elevator in the world. Present capacity 3,500,000 bushels. A second annex to hold an additional 2,500,000 bushels is rapidly nearing completion.

### Fort William.

The city lies low at the outlet of the Kaministiquia River, which here empties itself into Thunder Bay by three mouths known as the Mission, the McKellar, and the Kaministiquia Rivers respectively. These three outlets are being dredged to a depth of 25 feet and a width of 400-500 feet as fast as conditions will allow, and will eventually give a dock frontage of 18 to 20 miles.

The facilities here found for rapidly handling grain between cars and boat are probably unexcelled at any port in the world. There are a dozen elevators scattered along the banks of the river, their present total capacities amounting to some 22,000,000 bushels. Of these that of the Grand Trunk Pacific Railway is by far the largest, having a capacity of three and a half million bushels. This forms the largest single elevator in the world and is absolutely fireproof, being constructed entirely of reinforced concrete and steel. Its cost was in the neighborhood of $1,250,000. A second storage annex is now being added, which will bring the capacity up to six million bushels. It will eventually be enlarged to ten million bushels and will then form one of four similar units which the G. T. P. have planned to erect at their Fort William terminals. The company will thus eventually have storage room for forty million bushels.

View in the Grand Trunk Pacific elevator at Fort William. This shows one of the five 36-inch rubber belts that transfer grain from the working house to the annex. In the distance is the tripper.

The G. T. P. elevator was constructed by the Canadian Stewart Co., Montreal, and represents the very latest ideas in elevator design. The track shed stands between the working house and the storage annex, and has four tracks, on each of which there are five receiving pits below track level. Thus, twenty cars can be unloaded simultaneously. The disposition of the grain on being received will depend upon its grade, its condition or its identity. It may be elevated and stored in the annex there to await shipment; if wet it may undergo the drying process; cleaning and separating may be necessary; or by a convenient system of spouting it may be delivered to cars or vessels.

All wheat cleaning is done on the ground floor, there being five sets of cleaning mills, three mills to a set. The grain is elevated by 19 legs, there being 5 receiving legs, 5 shipping legs, 5 cleaner legs, 1 flax leg, 1 screenings leg, 1 special oats leg and 1 leg to the drier. From the receiving pits in the track shed the grain travels on 36-inch rubber belts to the foot of the receiving legs in the working house. Each leg is equipped with a double row of 15 x 8 x 8-inch buckets, and has a capacity of 18,000 bushels per hour. On reaching the top floor in the cupola the grain is weighed in five large hopper scales, each of which has a capacity of 120,000 pounds (2,000 bushels of wheat) and is equipped with printing and recording mechanism. After weighing the grain is distributed to the various storage bins in the working house or the annex. Five 36-inch 4-ply belts carry grain from the working house cupola to the annex and five similar belts in the basement complete the return circuit to the shipping legs. A 42-inch 4-ply reversible belt conveyor in the cupola transfers grain lengthwise of the elevator from the weigh-scales to the annex belts, the car spouts or the working house bins.

### Power Equipment, Etc.

Power is purchased from the Kaministiquia Power Co., who deliver 3-phase current at 22,000 volts, 60 cycles. In a transformer house attached to the elevator this voltage is reduced to 550. Thirty-seven motors of the squirrel cage type are installed throughout the elevator and develop a total of over 2,500 H.P.

Waterfront of the Great Lakes Dredging Co's. plant on the McKellar River, Fort William.

A corner in the machine shop of the Great Lakes Dredging Co., Ltd., at Fort William.

Artificial lighting is afforded by some 800 incandescent drop lights of 16 c.p. each. Each hanging lamp is equipped with a wire guard, and the cables are enclosed in armored flexible conduits. The superintendent's office on the ground floor is connected by telephone

with all departments and the operation of the elevator is further facilitated by speaking tubes, electric bell signals and a series of red and green signal lights at each of the receiving and shipping legs.

**Coal Handling Plants.**

The twin ports are, of course, the transhipping points for enormous quantities of west-bound coal, the Customs returns for the year 1911 showing that during the previous season of navigation over 3,000,000 tons were received at Fort William alone. The C.P.R. old coal dock handled 1¾ million tons, the balance having been dealt with by the Fort William Coal Dock Co., Ltd. This company's plant was established on the Mission River near the G.T.P. terminals in October, 1910. The coal handling equipment was installed by the Hyle & Paterson Co. It consists of two bridges, equipped with 2-ton buckets and operated by 150 H.P. motors. Contracts for doubling the capacity of the plant have just been completed by the Brown Hoisting Machinery Co., Cleveland. The new tower has a single bridge, with a 5-ton bucket and will be able to unload 3,000 tons of coal a day, which is equal to the capacity of the two old bridges combined.

Last year much coal had to go West via Duluth and Superior, owing to lack of sufficient apparatus to handle it at Fort William and Port Arthur, but as soon as the new terminals of the G.T.P. and the C.P.R. are completed this condition of affairs will, it is hoped, be a thing of the past. The coal dock at the C.P.R. terminals, which has just been completed, is of the most modern description and has a total storage capacity of 2 million tons. There have been installed two Hulett electrically operated 8-ton coal unloading machines, one 9-ton rehandling bridge, three 35-ton scale lorries, and about 3,000 ft. of bin and trestle system, as well as Christy box car loaders. It is expected that this

Ice breaker "James Whalen" at work in Port Arthur harbor. She is the property of the Canadian Towing and Wrecking Co., Ltd., Port Arthur.

Great Lakes Dredging Co's. Floating Drydock with tug "Sarnia." The dock will lift boats of 1,000 tons, drawing 15 ft.

In addition to this huge elevator there are a dozen others, five of which are owned and operated by the Canadian Pacific Railway. Of these the largest, known as C. P. R. Elevator D, has a present capacity of 1¾ million bushels, and is now being enlarged to hold an additional 1,600,000 bushels.

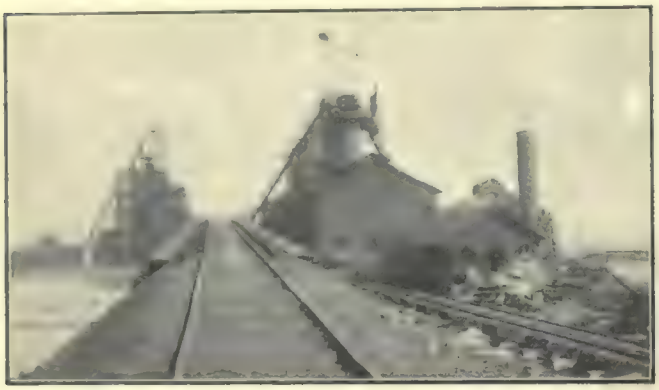
Mention must also be made of the large flour mill and elevator of the Ogilvy Flour Mills Co., Ltd. The mill is fitted throughout with the very latest equipment and has an output of 3,500 barrels daily. The elevator is of reinforced concrete and has a storage capacity of 1¼ million bushels.

The two grain elevators of the Canadian Northern Railway at Port Arthur. Their combined capacity is 7,000,000 bushels. Additions are about to be made with a view to doubling this capacity. The illustration shows the elevators as seen from the lake.

plant will very readily handle the largest boats that are in use on the great lakes, in one day's time—10 hours.

To give an idea of the size and capacity of these machines it may be mentioned that the motor equipment on each of the coal unloaders consists of a total of 550 h.p. and the bridge is equipped with motors aggregating 700 h.p.

All this coal handling equipment was supplied and installed by the Wellman-Seaver-Morgan Co., Cleveland.



The Atikokan Iron Co's. Blast Furnace, Port Arthur. Output 200 tons daily. The Roasting Plant on the left of the track has a daily capacity of 500 tons of ore.

Hydraulic Dredge "Shuniah" digging steamboat channel and reclaiming land at Western Drydock and Shipbuilding Co's. plant, Port Arthur. The "Shuniah" forms a unit in the large fleet of the Great Lakes Dredging Co., Ltd., Port Arthur.

The Grand Trunk Pacific Railway are also constructing extensive coal docks with a storage capacity of one million tons. These are located at their terminals on the Mission River, opposite their grain elevator.

### Great Lakes Dredging Co.

Another prominent concern located on the water front is the Great Lakes Dredging Co., Ltd. This is really a Port Arthur company, since its offices are in that city. However, its yard and workshops are in Fort William on the McKellar river, and it is generally looked upon as a Fort William industry. The company does a general dredging business and has a large fleet of dipper and suction dredges, tugs and scows. The plant consists of machine shop, pattern shop, blacksmith shop, boiler shop and storehouse. In their yard the company build all their wooden dump scows, derrick scows, dredger hulls, etc., and look after the complete upkeep of all their outfit. The equipment includes a small floating drydock shown on page 367. The dock is 100 feet long by 70 feet wide and will lift boats of 1,000 tons displacement and drawing 15 feet. It is fitted with two sets of pumps, one of the plunger type and the other of the motor-driven centrifugal type; so that either steam or electricity may be used as circumstances may render most convenient.

### The Canada Iron Corporation, etc.

One of the largest industrial plants in Fort William is that of the Canada Iron Corporation. These works give employment to about 350 men.

The various buildings occupy a site of 22 acres on the left bank of the Kaministiquia River, about five miles from the city hall. They comprise machine shop, pattern shop and four foundries for the production respectively of general castings, car wheels, brake shoes and pipe.

In addition to this plant the Copp foundry employs a number of men, stoves being the principal output. As the Thunder Bay district abounds in iron ore the future of both the cities is linked with the exploitation of iron and steel manufacturing. The Canada Car & Foundry Co., have recently commenced the erection of a large plant in Fort William and a nut and bolt factory will be established in the near future, while other steel and iron industries are about to be located in Port Arthur, as will be hereafter mentioned. Thus it is clear that a very few years' time will see full advantage taken of all the natural resources of the district.

### The Kaministiquia Power Co.

One or two concerns in Fort William generate their own power, but the very great majority purchase power from the Kaministiqua Power Co., Ltd., who have a hydro-electric generating station situated at the Kakabeka Falls, about 14 miles above Fort William. The present capacity of this generating station is 21,000 h.p., but the intake works, power house, etc., were built sufficiently large to allow of additional equipment being installed which will eventually bring the output up to 50,000 h.p. The rates charged are understood to be $23 to $25 per horse power per year of 365 days.

### Port Arthur.

Port Arthur is picturesquely situated on a hillside, and in this respect has the advantage of Fort William, which stands on a flat, uninteresting site. Both cities have many fine residences, the number of these in Port Arthur being especially noticeable.

As is well known, the C.P.R. in the early days made Port Arthur their Lake Superior depot, but after a few

Two vessels in drydock at the plant of the Western Dry Dock and Shipbuilding Co., Ltd., Port Arthur. This dock is 700 feet long, 98 feet wide and has a depth of water over the sills of 16 feet.

years deserted the place and moved on to Fort William. This of course was a great loss to the former town, and to the outsider Port Arthur seemed destined never to be anything more than a residential city. However, its citizens never let their ambition and enthusiasm cool, and by and by Mackenzie & Mann came along with the Canadian Northern Railway, and promptly set about developing the water front, building docks, etc., until they have long since filled the blank left by the C.P.R.

As evidence of their faith in the future of the city as an industrial centre, apart from its importance as a grain handling port, the C.N.R. opened in March, 1911, a fine hotel of 110 rooms. This is known as the Prince Arthur, and occupies a commanding position overlooking Thunder Bay. The accommodation provided quickly proved inadequate and the hotel has, this year, been enlarged to 150 rooms.

### C.N.R. Elevators, Coal Dock, etc.

A grain elevator is seldom a thing of beauty from an artistic point of view, but we think it would be difficult to find an example less objectionable in this respect than the C.N.R. elevator at Port Arthur, a view of which is shown on page 367. The elevator consists of two units, A and B, with a total capacity of seven million bushels. Each unit has a working house, which is tributary to a storage annex of 2½ million bushels. Elevator A was erected in 1901, the other being added three years later. The working houses are of wood, while the annexes are of the Barnett-McQueen Co.'s patented hollow tile construction. Both elevators are driven by steam, the engines and boilers being built by Goldie & McCulloch, Galt, Ont. Engine room A contains a single cylinder condensing Wheelock engine of 650 h.p., steam for which is provided by three return tubular boilers. Engine room B is equipped with a twin cylinder Wheelock engine of 1,000 h.p. This also runs condensing and is supplied by four boilers similar to those in A. These boilers also provide steam for a Hess dryer located in a separate building near power house B. This dryer has a capacity of 750 bushels per hour of tough grain or 500 bushels for damp or wet grain. The combined unloading and shipping capacity of the two elevators is: Unloading, 30 cars per hour; shipping 180,000 bushels per day. The C.N.R. are about to enlarge these elevators very considerably. Report says that their capacity is to be doubled.

This company's coal dock built in 1906, is also being greatly enlarged. When completed it will have a storage capacity of 500,000 tons and will be able to unload 1,200 tons per hour. This contract is being put through with all speed by the Barnett-McQueen Co.

The important plant of the Western Drydock and Shipbuilding Co., Ltd., at Port Arthur, forms one of the city's principal industries. This plant was described at considerable length in the issue of "Canadian Machinery and Mfg. News" for May, 1912, to which we would refer readers who are interested.

The Port Arthur Wagon Works, recently opened, is another important concern giving employment to 200 men.

View in the annex of C.N.R. Elevator "B," Port Arthur. Some of the bins are here seen full to the top with golden wheat from Canada's Western provinces.

DOCKS AT THE FOOT OF ARTHUR ST., PORT ARTHUR.

This firm will eventually turn out 15,000 farm wagons a year.

Among other concerns that call for mention is the Pigeon River Lumber Co., whose mills have an annual capacity of 50,000,000 feet of lumber. Stewart & Hewitson operate an extensive quarry and rock-crushing plant which is taxed to its utmost capacity, owing to the large demands for road-making and construction work.

Another important plant is that of the Atikokan Iron Co., who operate a blast furnace with a capacity of 200 tons per day. The ore is brought from the Atikokan range 126 miles to the West on the C.N.R., and is of a high grade containing over 60 per cent. of metallic iron. The company manufacture their coke from West Virginia coal in a range of 100 beehive ovens having a total capacity of about 150 tons per day of 24 hours.

The blowing engines for the blast furnace were built by the Southwark Foundry & Machine Co., Philadelphia. They have a capacity of 30,000 cubic feet of air per minute at 15 lbs. pressure, though 10 lbs is the pressure actually used. Steam for these engines is supplied by four Canada Foundry Co.'s double furnace water tube boilers, fired by the waste gases.

The Atikokan Iron Co., is a Mackenzie & Mann interest, and was started largely as an experiment. However, it turned out so successful that it was decided to follow it up by the establishment of a large steel works on the northern outskirts of the city. This will be an $8,000,000 concern and will turn out rails, angles, structural shapes, etc. The starting of such a plant will ,of course give a tremendous impetus to the city.

Another concern which is now starting work on a large scale is the Ontario& Western Car Co., Ltd., who are building a $5,000,000 plant to turn out steel and wooden cars of every type for steam and electric railroads, street railroads, contractors' dump cars, etc., etc. This plant will give employment to 1,000 men.

### The Whalen Interests.

Mr. James Whalen, a long-time resident in Port Arthur, has numerous interests in that city. Besides being president of the Western Drydock & Shipbuilding Co., he is interested in the following concerns, viz:—The Great Lakes Dredging Co., Ltd., the Canadian Towing & Wrecking Co., Ltd.; the Canada Pebble Co., Ltd., and the Thunder Bay Contracting Co., Ltd. The last named company had the installing of much of the new coal handling plant of the C.P.R. at Island No. 1, Fort William, and are also putting in about 4½ miles of crib concrete dock at the G.T.P. terminals on the Mission River.

The Canadian Towing & Wrecking Co. have a fleet of eight tugs and three wrecking barges fitted with clam shell buckets for handling cargo. The barges are fitted with wireless telegraphy to enable orders to be transmitted to them from shore. When not engaged on wrecking work they are used for gathering sand and gravel from lake beaches for use in making concrete. The twin harbors are at present using some 60,000 cubic yards of sand and gravel annually. The ice breaker tug "James Whalen," belongs to this fleet and is illustrated on page 367. She was built in 1906 by the Polson Iron Works, Ltd., Toronto, and has done useful work each spring in hastening the opening of Port Arthur harbor. Her dimensions are:—Length overall, 108 ft.; beam, 24 ft.; depth, 14½ ft. Her cast steel propeller is 10 ft. 6 in. in diameter and is driven by a 20-40-36 fore and aft compound jet condenssing engine. Steam at 160 lbs. pressure is supplied by a Scotch marine boiler 12 ft. 6 in. in diameter by 12 ft. long. Her speed in summer is 11½ miles per hour.

The Canada Pebble Co., is a concern engaged in gathering granite pebbles for use in tube mills, and for grinding cement clinker, copper ore, etc. They are also used by paint manufacturers for grinding their lead. These pebbles are found in large quantities along the north shore of Lake Superior and are sorted by screens into sizes varying from 1½ to 4 inches, and are loaded into bags for shipment.

### General Features of the Two Cities.

The intervening six miles between the two cities is traversed by a double track street car system, on which very fine cars of the pay-as-you-enter type give an excellent service. The system is owned and operated by the two municipalities as is the telephone service, which is efficient and remarkably cheap.

Both cities have well paved streets and fine stores, and are well provided with churches, schools and hospitals. Their growth in the last ten years has been truly wonderful and it is certain that their expansion during the coming ten years will be even more marked.

## CALLS FOR MACHINE TOOL EQUIPMENT.

THE National Transcontinental Railway Commission has issued a list of machine shop equipment requirements, amounting in value to about $40,000. The following items are included:

One 80-inch motor-driven wheel lathe.

One 30-inch by 8-foot motor-driven planer.

One 4-foot motor-driven radial drill.

One 28-inch by 16-foot motor-driven gap lathe.

One 20-inch by 10-foot motor-driven double back geared engine lathe.

One 16-inch by 8-foot motor-driven high speed double back geared engine lathe.

One 20-inch motor-driven drill press.

One 16-inch motor-driven shaper.

One 4-inch motor-driven pipe machine.

One 2-inch motor-driven bolt cutter.

One 500-pound motor-driven power hammer.

One 36-inch motor-driven grindstone.

One 30-inch motor-driven band saw.

One 24-inch pony planer.

One 14-inch portable bolt lathe.

Two forge blowers.

Three portable cranes.

Two 400-pound anvils.

### Eastern Car Co., New Glasgow, N.S.

Another large list calling for about 40 machines has been issued by the Eastern Car Co., New Glasgow, N.S. All the machines are for early delivery and are to be arranged for motor drive, but the motors are not to be included in the bids. Prices are to be made f.o.b. New Glasgow. The complete list is as follows:

Two 125-inch gate shears, 24-inch throat.

One 62-inch gate shear, 24-inch throat.

One double angle shear, 6 x 6 x ¾ inches mounted on turntable.

Two multiple punches, 120 inches wide.

One multiple punch, 125 inches wide and 18-inch throat.

One mill plate punch, 12 feet between housings.

Three open gap punches, 24-inch throat, 1½ inches through 1 inch.

Two open gap punches, 24-inch throat.

Two horizontal punches; gap 10 feet deep.

Two horizontal punches with four gagged punches adjusted horizontally, two inches either side of centre.

One No. 9 bulldozer, 24-inch stroke.

One No. 20 bulldozer, 20-inch stroke.

One No. 23 bulldozer, 16-inch stroke.

One 2-inch upsetter.

One 1½-inch upsetter.

One bar shear, 2 x 12 inches.

One bar shear, for 2-inch rounds.

Two Bradley hammers.

One hydraulic wheel press, steel pressure 200 tons, for 33-inch wheel.

Five axle lathes, with or without cranes.

Two heavy wheel boring mills, with cranes.

One tool grinder.

Two spindle arch bar drills.

One 2,000-pound steam hammer.

One 400-pound steam hammer.

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Vol. VIII. DECEMBER, 1912 No. 12


## A PHASE OF BUSINESS MANAGEMENT.

WISE and tactful administration of a business, be it large or small, and of whatever nature, is, as we all know, highly contributory to success in the broadest sense of the term, but while the director as well as the directed, step aside from or overstep the mark every once in a while, yet rarely, except on the eve of some pending "strike," do we hear of the former being publicly challenged for doing so.

It is not our intention to discuss here the general question of management, but rather to confine our observations to that phase of it which harasses a whole army of employes for the sins of omission, commission or incapacity of a few. There are men in every employ, scrupulous and high-principled, who resent being dubbed publicly as "black sheep," and who are not slow in many cases to say so. We speak from experience in this matter, and while the operation of the practice of harassment was in some instances more distasteful than in others, it nevertheless gave evidence, and will always do so, of a lamentable lack of wisdom and judgment on the administrator's part. Incapacity of an employe may induce or make it necessary for him to take all manner of abuse and impertinence from his superior, but that is no reason why the latter should spread himself and shower his vituperation broadcast. The error of it all seems to us to lie in the fact that incapacity is tolerated in employes for the display of management vanity. We have seen men herded and driven by every form of abuse, yet retained in the employ year after year, and, other than for the reason stated, we fail to see why, unless it be that their service is cheap and their output under the circumstances worth it.

Another feature of this question has got, however, to be accounted for, and the almost universal tendency to overlook it, not only creates discontent among employes of the right stamp, but interferes materially with their best efforts. As we have said, the innocent suffer with the guilty, and on account of, it may be, the smothered resentment aroused, these former, even in spite of themselves, debate the question of its being "worth while," thereby killing the "glory" aspect of their calling, and glorifying the pecuniary side unnecessarily. It may be urged, perhaps, that the "glory" feature of a man's profession or trade is somewhat of, or altogether a myth, but those who claim so, are lacking in and ignorant of the most essential qualification in men management. There are more employes who pride themselves on achievement than most of us imagine, and instead of trying to stifle this desirable attribute, it should be the earnest endeavor of every administrator to foster and increase it. As we have said, the inclusive attitude adopted or similarity of treatment meted out is the very antithesis of this, and neither makes for harmony, goodwill or ultimate business success. Some men, we are well aware, require driving, some need leading; others, however, will neither be driven or led, and management worthy the name and in superlative degree should discern these qualities in its servants and act and administer accordingly.

## THE EDUCATIONAL TREND.

IN another part of this issue will be found an article entitled the "Education of Manual Workers," and who shall say that it does not contain much food for thought on the part of those who would lead and direct the educational side of the factory operative's nature. It will be noted that the writer's remarks are based on a wide variety of employment, and that the observations embrace numbers of employes running into hundreds of thousands.

In our November issue we dealt with the subject of technical education, and pointed out the ridiculously small percentage of those who really benefited by it. Mr. Dixon states that from 90 to 95 per cent. of manual workers need little more, from the educational standpoint, than the "three R's," and in this, as a result of his inquiries and investigations, he is backed by the practically unanimous opinion of those who direct our great industries. Men without an excess of education required for the pursuit of their calling, are, in the experience of all of us, much more contented, and were only a little more prominence given to the "dignity of labor," and a fuller realization had of the importance to our national welfare of the manual worker, fewer unseemly disputes would mark his relationship to capital.

We suggest to our readers the careful perusal of this article, and at the same time make intimation of our purpose to open the columns of our journal for an expression of views from those who care to give it on this interesting topic.

## ACCIDENT PREVENTION.

IT is pleasing to note the earnestness of purpose with which our large employers of labor are prosecuting the development of means, methods and devices, whereby the accident record of our industries and enterprises may be reduced both in frequency and seriousness. The co-operation of the employe is, needless to say, the complement of their work, and that this will not be lacking, we are quite sure.

# MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

## SELF-STARTER FOR AUTOMOBILE AND MOTOR BOAT ENGINES.

by W. M. Brown.

THE principal features and advantages of this device are its simplicity cheapness of construction and lightness. It provides a means whereby an automobile engine can be started from the driving seat, thereby eliminating all risks inseparable from the process of "cranking up." Fig. 1 shows a cross section of the mechanism and Fig. 2. is a side view. The various parts are similarly lettered in each view.

The starting lever (L) is fulcrumed to a side member of the frame;—see Fig. 1. Attached to it is a cable (H) which passes around the guide pulley (J) and the split pulley (B). This cable is fastened to the upper end of a lever (E). Attached to this lever at two points below the fulcrum is a steel band (E) fitted with fibre strips (D), as in a band brake. This surrounds a split drum (A) which grips the engine shaft (Z).

When the operator pulls on the starting lever (L) the first result is to pull over the lever (C) by means of the cable (H), thus firmly gripping the drum (A) by the band (E) and fibre pieces (D). Circular motion is then transmitted to the crankshaft of the engine by continued pressure being applied to the starting lever the whole mechanism revolving until the lever (C) strikes the knock-off block (O). This relieves the grip of the band on the drum (A), but by this time the engine will have been given sufficient compression to fire. The operator now pushes foward the starting lever to its original position, and the coil spring (P)—see Fig. 1, returns the pulley (B) back to its starting position with the stop block (M) resting on the rubber cushion (N). The spring (F) holds the fibre strips clear of the drum (A) when the engine is running.

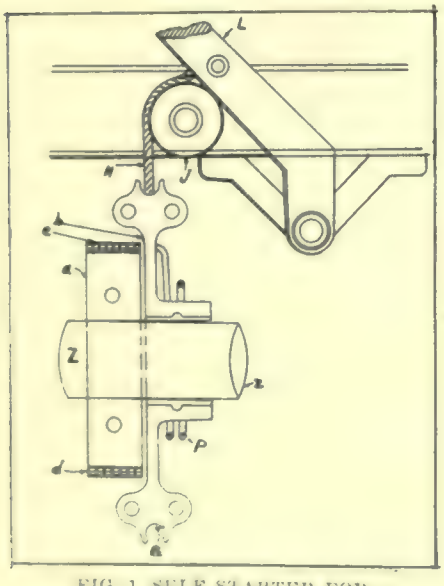


FIG. 1. SELF STARTER FOR AUTOMOBILES, ETC.

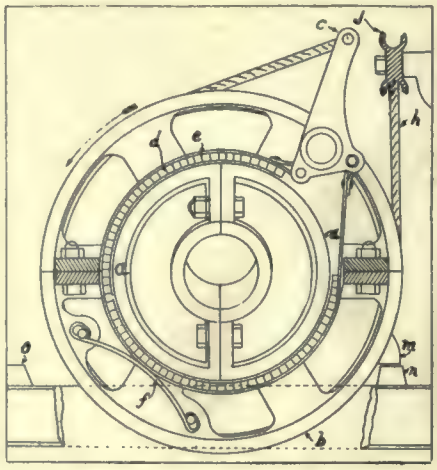


FIG. 2. SELF STARTER FOR AUTOMOBILES, ETC.

This self-starter is patented by Charles Hickling, Collingwood, Ont.

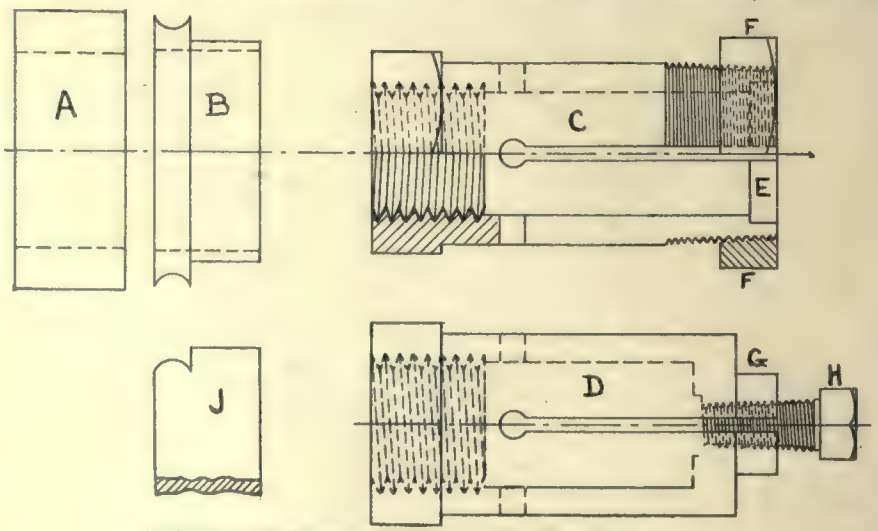
## MAKING SPINNING RINGS IN A JOBBING SHOP.

By G. Barrett.

AT one time we received an order for 800 rings for ring spinning, and as considerable trouble was experienced in turning and boring them in the usual way, the writer devised the method herewith described and illustrated.

In filling the order, the first step was to have the blacksmith make the rings from 1 inch by ⅜ inch mild steel stock, as shown at (A). A finished ring is seen at (B). The rings were bored and turned with the aid of two cast-iron chucks, (C) and (D). Chuck (C) is made compressible and chuck (D) expansible by four saw cuts as shown. Both are screwed at one end to suit the lathe spindle. For boring, the rings are inserted in the recess (E) at end of chuck (C). This end of the chuck is screwed with a taper thread, so that by advancing the steel nut (F), the ring is firmly held. After boring, they are ready for turning on the chuck (D) which really forms an expanding mandrel. The rings are slipped on to the projection (G) and the mandrel is then expanded by the taper screw (H). Much time was saved and accuracy of outline assured by the use of the forming tool shown at (J). The slide rest also was fitted with a stop, thus allowing boy labor to be used without incurring the risk of any variation in the diameter of the rings.

NOTE.—In the cut, the chucks are not drawn to the same scale as the rings (A) and (B) and the forming tool (J).



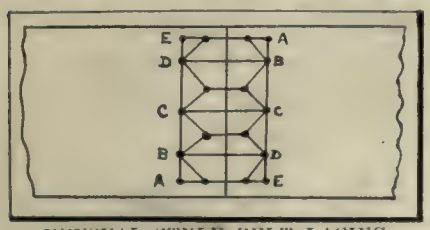

MAKING SPINNING RINGS IN A JOBBING SHOP.

## BELT LACING.

By J. E. N.

THE recent article on styles of belt lacing reminds me of the unusual one here illustrated. Although a rather fancy affair, it is very serviceable. This lacing should only be used on belts over eight inches width, as it is too elaborate for small belts. However, after lacing

a few joints, it will be found possible to make this joint about as rapidly as the ordinary types. The unique feature of this lacing lies in its being the same on both sides of the belt. Since it con-




UNUSUAL STYLE BELT LACING.

tains angles and triangles many will claim that it is no good, and that all lacing should be straight on the pulley side. The designer himself made the foregoing remark to me; further stating that he had been lacing belts off and on for over twenty years and had never used a style giving better satisfaction than this one.

There are five holes at the back and only four at the front edge, which is directly opposite to the usual practice. The lacing is started at the centre and finished at E. on each side. Holes A, B, C, D, E, are laced once more, then if all the other holes are double laced the holes mentioned are laced three ply. It is said that when well hammered with a wooden mallet, the joint will run smoothly and outwear many straight-laced styles.

## A CYLINDER PROBLEM.

By D. A. Hampson.

WE recently had occasion to use some cylinders of the sizes indicated in the drawing. It will be seen from Fig. 1 that each end carries a cored hub supported by a six arm spider and the first glance at the blue print made us shrink from the somewhat expensive pattern and core-box that seemed to be inevitably required. As there was little possibility of a second lot ever being made, the foundry foreman was consulted and he evolved a time (and labor) saving plan which is shown by the second figure. Instead of making the usual longitudinal divided pattern, a cylinder, 11½ and 13 in. x 9 in. long, Fig. 2, was constructed, and the spider, hub and six arms were built as a separate piece, and a sliding fit in the cylinder. The spider carried the core print for its hub.

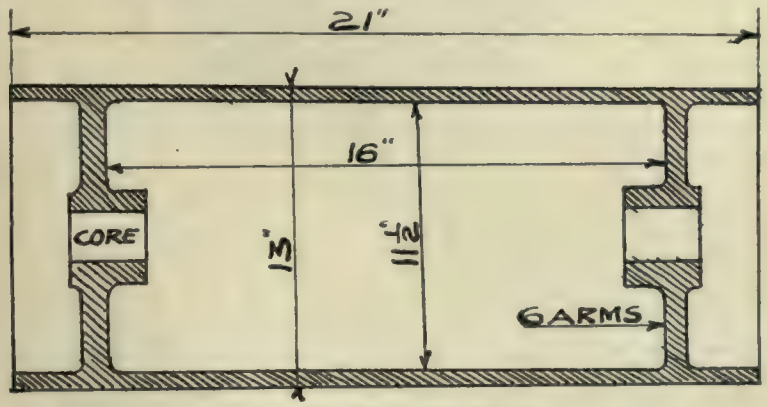



FIG. 1. A CYLINDER PROBLEM.

The piece was molded and poured on end. As shown, the spider and cylinder section were put in and rammed up. Then the cylinder, having been rapped sufficiently to withdraw it, was raised 6 inches, carefully straightened up and again rammed. This process was repeated, and at the correct spacing, the spider again inserted. An extra half inch of cylinder was added in the cope to turn off the poorest part of the iron.

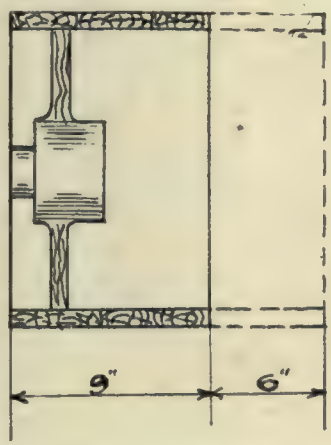


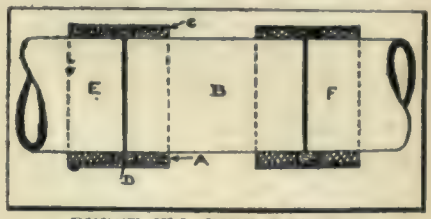

FIG. 2. A CYLINDER PROBLEM.

Our cylinders turned up perfectly clean, had little excess of stock to come off for straightening, and were well balanced. The patterns were made in a day's time and the general impression left by the job was most pleasing.

## BURST WROUGHT IRON PIPE.

By Steamfitter.

LAST winter an engineer struck a snag. A wrought iron pipe 3 inches diameter froze up and burst. It was a cold water pipe in more ways than one before it was fixed, being in a place very difficult to reach. As it meant breaking a couple of walls to withdraw the length he used a hack saw and cut out the piece shown at B. He next cut another piece of good pipe, of equal length, and it be-




BURST W.I. PIPE REPAIR.

ing impossible to thread the ends E and F., the problem of how to make connection confronted him. Engineers as a rule are hard men to stick. He secured two 5-inch couplings, placed them over the two ends E and F, and ran them back far enough to get the new piece of threadless pipe B inserted. The couplings were then placed in the positions shown. Oakum was packed into the centres as shown at D and lead run into the ends as shown at A. After caulking up the latter firmly the water pressure (80 lbs. to the square inch), was turned on, and no trouble has been experienced since.

## ELECTRICITY SUPPLY.

THE opening address by Mr. S. D. Schofield, read at Leeds before the Institution of Electrical Engineers, referred mainly to electricity supply.

One of the main points to be considered in the future, he said, would be the fixing of standard pressures and periodicities, and engineers interested in the manufacture of motors or incandescent lamps well knew what a boon this would be to them. The day of small supply stations was passing away, and if electrical energy was to be universally adopted for industrial purposes, at prices which would be profitable alike to the producer and the consumer, it could only be done with large generating units at stations where fuel could be obtained easily and cheaply, and where an abundant supply of water for condensing purposes was available. Generating stations which were put down to supply direct current, and for economic reasons were necessarily in the centre of a given area, would be dismantled and utilized as sub-stations, taking current in bulk from a large central station. The question as to whether these large stations would be controlled by companies or by groups of local authorities would settle itself in the future.

### Electrical Engineering Activity.

At no time in the history of electrical engineering was there such a marked activity in all its branches as there was

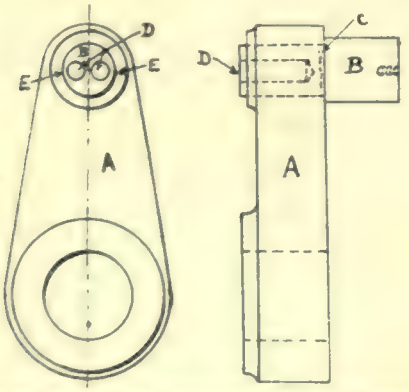
to-day. The textile manufacturers had found out how their interests were best served, and apparently were adopting the electric drive as quickly as it could be installed. The advantages of electricity for heating and cooking were being realized, and if the new demand was properly developed, it would mean not only an increase in the quantity of apparatus in use, but also new and heavier mains, and additional generating units.

One result of the excellent plant now provided for electricity generation and distribution was a tendency on the part of engineers to become stereotyped in their methods, and in too many cases to refuse new business because it did not fall in with "red tape" conditions. Supply engineers should be always open for business, if there was a margin on the right side in it, even if it compelled them temporarily to overload the plant and mains. To-day, with the first-class plant available and with standardization, there was a tendency to practice caution until it ceased to be a virtue.

## EXTRACTING FRACTURED CRANK PINS.

By Alfred V. Begbie.

IN the drawing, A represents the crank arm and B the crank fractured at C. To remove the pin, two holes (D) are drilled with the aid of a ratchet or some easier method. These holes should be of such size as to remove as much metal




EXTRACTING FRACTURED CRANK PINS.

across the diameter of the pin as possible, without endangering the hole in the crank arm, and of depth to come short of the fracture. The web between the two holes is next cut through with a chisel, and if necessary to still further weaken the pin, a round nose chisel may be used to thin down the walls between the holes D and the hole in the crank arm at EE. By placing a steel bar in one of the holes D and with a good husky man at the end of a sledge handle and a suitable block on the face of the crank, the offending pin is usually easy to drive out.

## PRIME MOVER CENSUS IN U.S.A.

FIGURES of the power census in the United States in 1909 have been published. Renting electric power is rapidly increasing. Gas engines are used largely in certain parts where there are gas wells. Water wheels are used most largely in New England, but even there, constitute one-fourth of the total power. The percentage division of the 1909 total is:—Steam, 76.0; gas, 4.0; water wheels, 9.7; water motors, 0.1; others, 0.2.

| Primary power. | Number of engines. 1909. | 1904. | Horse-power. 1909. | 1904. |
|---|---|---|---|---|
| Total ..... | 408,472 | 231,363 | 18,680,776 | 13,487,707 |
| Steam ..... | 153,482 | 127,267 | 14,202,137 | 10,825,348 |
| Gas ..... | 34,352 | 21,515 | 754,083 | 289,423 |
| Water wheels | 20,126 | 19,595 | 1,807,144 | 1,641,949 |
| Water motors | 1,203 | 1,397 | 15,449 | 5,931 |
| Other ..... | .... | .... | 29,293 | 92,154 |

## INTERESTING APPLICATION OF AUTOGENOUS WELDING.

AN interesting application of oxy-acetylene welding for correcting an error made in a machine shop is here shown. The gear wheel seen in the illustration is about 4 feet in diameter and weighs approximately 1,000 pounds. This gear had 23 teeth cut. After ten teeth had been cut the full size, the index of the machine was accidentally moved and the 11th tooth was cut half a size too small. The machine operator then adjusted the index properly and cut the other 12 teeth, which, of course, were out of position on account of the 11th tooth being too small.

Under other circumstances this casting would have had to be thrown upon the scrap heap; but by utilizing the process of autogenous welding, this waste was avoided and the casting saved. The method of making the alteration is pretty clearly shown in the photograph. The section showing the first 10 teeth cut out, as seen in the illustration, was replaced with the aid of a templet, in such manner as to bring all the teeth into correct alignment. The piece was then clamped firmly to the casting, the oxy-acetylene flame applied, and the piece welded so that it was quite as good as new. Thus instead of recutting all the teeth, only two had to be re-cut—one at each end of the welded section.

The cost of the casting, including the work done previous to welding, was about $45.00. The welding process cost $30.00, thus showing a direct saving of about $15.00 and an indirect saving very much greater; because the blank was made good within 24 hours after the mistake happened, whereas, had it been thrown on the scrap heap, not only would the work have been lost, but a considerable delay would have ensued before a new casting could be obtained. This is only one of the many ways in which the oxy-acetylene process can be brought to the direct aid of machine shops to save them time and money and incidentally

AN INTERESTING APPLICATION OF AUTOGENOUS WELDING.

their reputation for good work; as for instance, when mistakes of the above description happen.

We are indebted to the Franco-Canadian Welding Co., 331 Yonge St., Toronto, for the above particulars, and the photograph from which our cut was made.

## SIMPLE SAFE LOCK NUT.

By U. M.

TO make a nut that will never get loose by vibration, cut a slot in it with a hacksaw as at A, before threading. With a cold chisel as a wedge,

SIMPLE, SAFE LOCK NUT.

force the piece B. down a little. Now thread the nut, apply and tighten up in place, and no lock nut will be necessary.

**New Hamburg, Ont.**—The Electrical Utilities Co., Toronto, Ont., has its new buildings at New Hamburg, Ont., nearly completed. The plant will include a brass foundry, iron foundry, machine shop, electro-plating and woodworking departments. Complete equipment will be required. James Fowler is president, and R. F. Smith, secretary.

# DEVELOPMENTS IN MACHINERY

## A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

### NEW JAR-RAM ROLLOVER AND PATTERN DRAWING MACHINE.

THE jarring moulding machine, with an independent rollover and pattern drawing device, shown in the accompanying illustrations, has just been placed on the market by The Herman Pneumatic Machine Company, of Zelienople, Pa. The purpose of a machine of this character is to give a good rollover action and a perfect pattern draw. The machine is operated entirely by compressed air. Fig. 1 shows jarring machine to be independent from the rollover device. The connecting arms that extend from the rollover mechanism, engage trunnions on the rollover plate, which rests on the jarring machine. The pattern and flask are secured to the rollover plate.

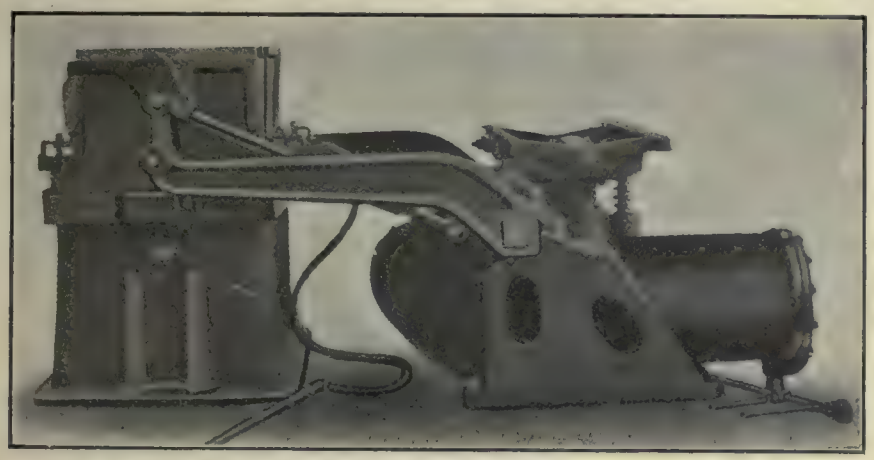


FIG. 1. THE MACHINE IN POSITION FOR JAR-RAMMING THE MOULD.

While the jarring operation is taking place, the side rollover arms remain stationary. Then, after the mould has been jarred, air is applied to the rollover cylinder, which causes the rollover plate together with the flask to rise, when the lifting arms engage the rollover plate. The rollover action is accomplished by a small arm which is connected to the trunnion on the rollover plate and the fixed centres of the base of the rollover device. These centres, being somewhat shorter than those on the large arm, cause a rotating movement to the rollover plate as shown in Fig. 2. This rotating action continues until the stop on the rollover plate trunnion comes in contact with the equalizing and levelling device on the large rollover arm, which gradually brings the flask and rollover plate to rest, as shown in Fig. 3. Air is now admitted to the pattern drawing cylinder, the upper part of the ram of which is attached to the equalizing device used for taking up irregularities on the bottom board.

This pattern drawing cylinder rises until it meets the flask. The clamps are then removed and as the rollover plate is held in a firm position, the vibrator attached to the rollover plate is started and the air, exhausting from the pattern drawing cylinder, allows the plunger to descend as shown in Fig. 4. By exhausting the air from the rollover cylinder, the rollover plate with pattern is returned to its position, as shown in Fig. 5. Fig. 2 shows clearly that the rollover device has no connection whatever with the jarring feature; so that it remains serviceable for a longer time than it would ordinarily do if it were connected directly with the machine; moreover, the pattern is thus drawn more accurately.

The machine shown has a table of 30x45 in. and a lifting capacity of 5,000 lbs., while the rollover device has a capacity of 4000 lbs. The machine above described has an automatic, self contained control valve, attached to the jarring machine, which regulates itself automatically to the different loads it is required to lift. This valve is of the differential type and is entirely closed. Its operation does not depend on any external or exposed operating parts.

In the rollover device all moving parts are bronze bushed or babbitted and provided with adjustment for wear. The journals are provided with efficient oiling devices and are thoroughly protected with dust guards. The arms are made from vanadium steel castings and forgings. The rollover and pattern drawing cylinders are cast in one piece, thus ensuring that they will always maintain their correct relative positions, which is an important essential in this machine. The pistons are fitted with accurately ground lap joint packing rings; and both cylinders have properly designed cushioning devices which eliminate any possibility of breakage through careless handling. The equalizing device for taking up irregularities in the bottom board consists of a very simple arrangement of steel beams hung on one centre to allow of movement in all directions. The makers claim special advantages for the semi-elliptical springs seen in the cuts, Fig. 3 and 4. These are for the purpose

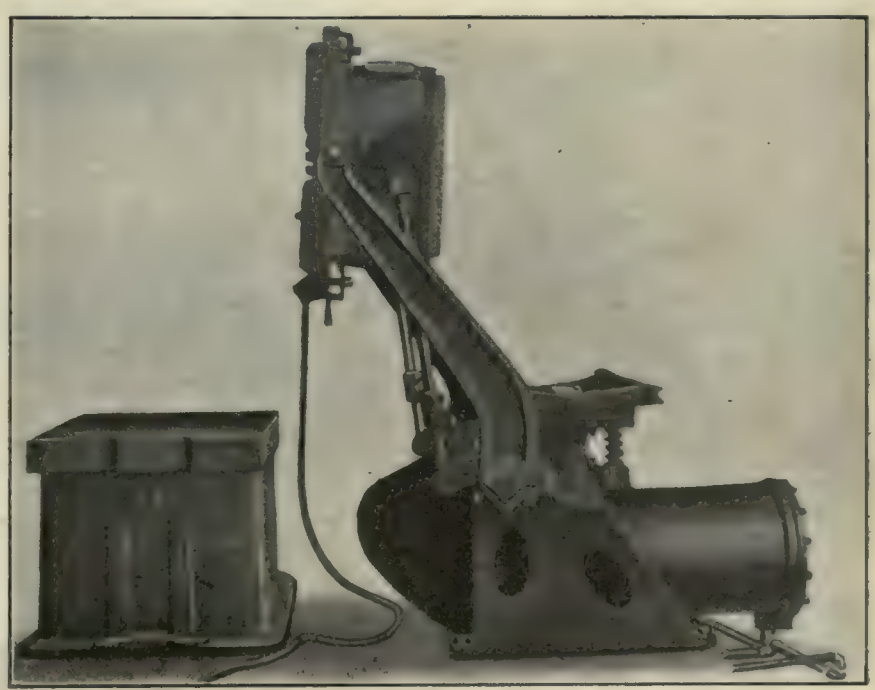


FIG. 2. THE MOULD BEING ROLLED OVER AFTER RAMMING.

of locking the equalizing device after it is pressed against the bottom board by the action of the pattern drawing cylinder. This method locks the equalizing device tight enough to prevent all danger of its shifting from the weight of the flask, once it is set.

This machine was exhibited at the Foundrymen's Convention, Buffalo, in September last and aroused a great deal of interest.

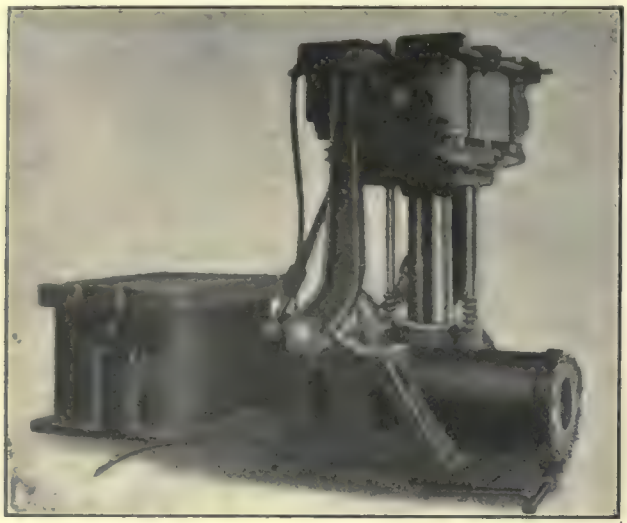


FIG. 3. MOULD ROLLED OVER. PATTERN ABOUT TO BE DRAWN.

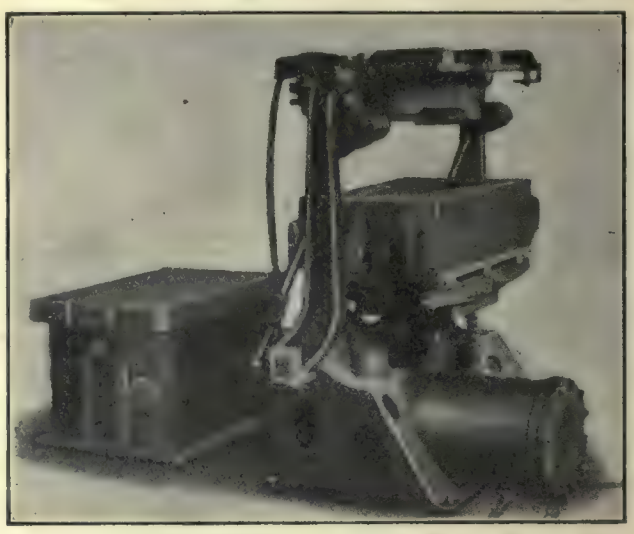
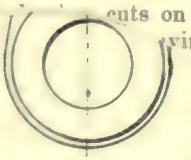


FIG. 4. THE PATTERN DRAWN.

## A NEW HACKSAW BLADE.

THERE has recently been placed upon the market a double action hacksaw blade, the invention of Mr. Alex. Reitlinger, 201 William Street, New York City, who has sent us a sample 8-inch saw for inspection. In this saw, the teeth face in both directions in alternate groups of four; that is to say, four teeth face one way and the next four the opposite way, and so on. The [illegible] cuts on both strokes, with a [illegible]ving of time over the [illegible]ed in a hand frame, [illegible]ouble action saw [illegible]r, while in a [illegible]ersed when [illegible]hus prac- in half.



EXTRACTING FRACTURED CRA

across the diameter of the pin as [illegible]tive sible, without endangering the hole [illegible]s the crank arm, and of depth to come short of the fracture. The web between the two holes is next cut through with a chisel, and if necessary to still further weaken the pin, a round nose chisel may be used to thin down the walls between the holes D and the hole in the crank arm at EE. By placing a steel bar in one of the holes D and with a good husky man at the end of a sledge handle and a suitable block on the face of the crank, the offending pin is usually easy to drive out.

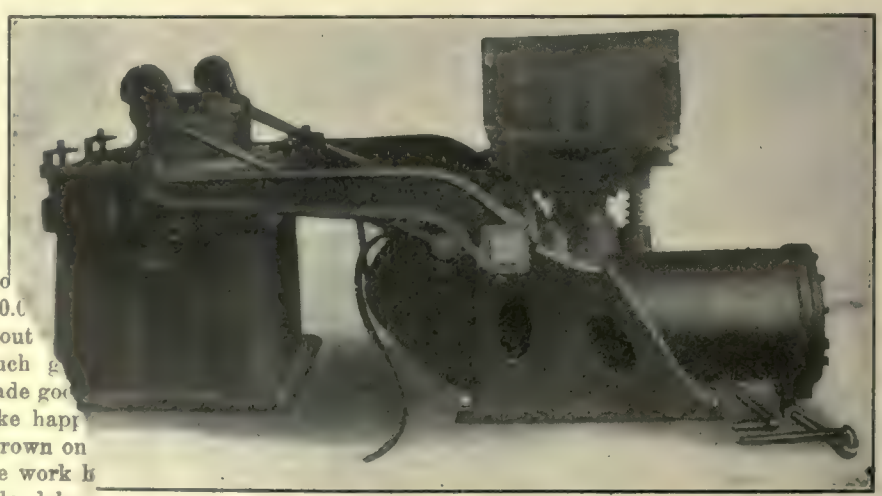
Co.'s Britannia Works, Middlesbrough, England, which was laid down by the British Thomson-Houston Co., of Rugby, in 1909, is operating to the entire satisfaction of the management.

The electrical equipment consists of a mill motor of 1,200-3,600 h.p., at 70-120 r.p.m., directly connected to the rolls, and supplied with continuous current at 0-440 volts by a flywheel equalizer set. This motor is fed from a 2,750-volt, 40-cycle, 3-phase supply, and is mounted on the same base-plate as, and directly coupled to, a generator rated at 1,000-3,000 kw. The speed of the set is 480 r.p.m., and the flywheel, which weighs 33 tons, and is 11 ft. in diameter, runs in its own bearings, and is connected to the generator by a special compression type flexible coupling.

The plant has proved itself capable of outputs considerably in excess of the makers' guarantees, and in practice, the mill motor is subject to overloads much higher than the maximum rating given above. It has not been found necessary to give any special attention to the commutators of the continuous current machines in order to ensure satisfactory operation. That of the mill motor has not been ground or trued up in any way since its installation, and the commutation of the generator is sparkless, although more than two years have elapsed since the commutator was ground up.

## EXTRA HEAVY DUTY BALL BEARING.

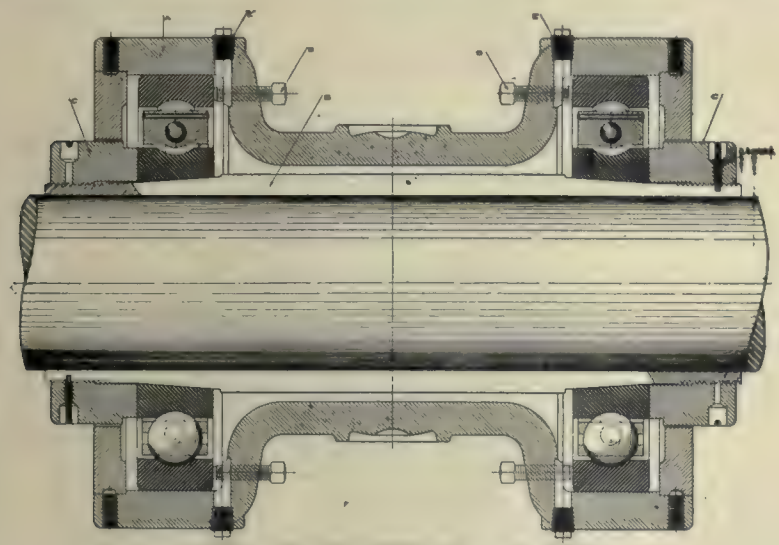
THE Chapman Double Ball Bearing Company of Canada, Ltd., Soraurен Avenue, Toronto, have just added to their regular line a new type of ball bearing specially suited for heavy duty transmission work. These bearings are regularly made in all sizes from 1 7-16 inches to 6 inches diameter inclusive, the one herewith illustrated being of the latter size. This is probably the largest standard bearing regularly manufactur-



THE MOULD READY TO BE REMOVED. THE PATTERN HAS BEEN TURNED TO TABLE OF THE JAR-RAMMING MACHINE BY THE ROLL-OVER ARMS.

ed by any company for transmission purposes.

As may be seen from the illustration, the bearing is of the double annular type, the large balls being 1⅞ inches diameter, and the smaller intermediate balls 11-16 inch diameter. The ball races are of best chrome vanadium steel, the



EXTRA HEAVY DUTY BALL BEARING.

cages being phosphor bronze. The sleeve (B) is made from a steel casting split partly through into six segments to allow of its being securely clamped upon the shaft by the heavy cast-iron nuts or collars (C). These collars are threaded with an Acme thread and securely locked by means of C-springs. Sufficient adjustment is provided to allow the bearing to be properly fitted to shafts varying from .005-inch oversize to .005-inch undersize. The housing is made specially heavy to give the races ample support and prevent their deformation under load. The lubricant (vaseline) is retained by the end caps seen in the cut. These bearings are designed to fit any standard type of hanger. The 6-inch bearing here shown weighs approximately 650 pounds.

In manufacturing work of this class it will of course be understood that a very high degree of accuracy is absolutely necessary. The ball races are hardened and afterwards ground on special machines which ensure absolute uniformity. In making the cages, special jigs and fixtures are used to ensure correct relationship between the large and the small balls. The balls themselves are imported from Europe under a guarantee that each one is accurate to .0001 inch; but even with this guarantee, every ball, no matter what its size, is micrometered and tested on receipt.

When installing these bearings they are slipped on the shaft and then placed in their hangers. After the shaft is coupled up, aligned and leveled, the collars (C) are screwed up until the sleeve (B) is tight on the shaft. The set screws (S) are for the purpose of preventing the bearing, when being placed on the shaft, from sliding on the sleeve and causing the latter to collapse. When the bearing is in place, and before the sleeve is clamped to the shaft by the collars (C), the set screws are slackened back about ¼ inch clear of the ball races.

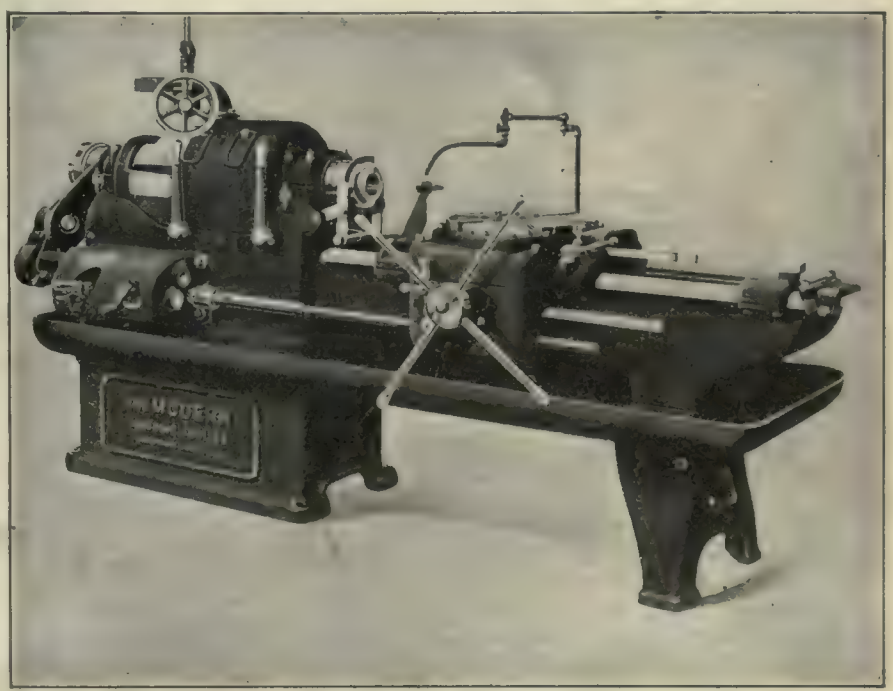
The Chapman Double Ball Bearing Co. has recently shipped to the Mississquoi Marble Co., Phillipsburg, Que., a complete transmission equipment, including six of these large bearings. Two of them are to take the pull of a 47-inch, 3-ply leather belt transmitting 360 horsepower. The main line shaft is 360 feet in length and reduces in size from 5 15-16 inches to 4 7-16 inches.

Another order now being shipped calls for 413 bearings of sizes varying from 2 5-16 inches to 4 7-16 inches, for the St. Maurice Valley Cotton Co., Three Rivers, Que. This is the third mill belonging to the same syndicate which has been so equipped, the other two being the Wabasso Cotton Co., Three Rivers, and the Shawinigan Falls Knitting Co., Shawinigan Falls.

## NEW FLAT TURRET LATHE.

THE Modern Machine Tool Co., Cincinnati, Ohio, is now building and putting on the market a new flat turret lathe, made from entirely new designs, massive in detail, and embracing all the features of the best and most modern forms of lathe construction. Careful attention has been given to the arrangement of its various parts, so as to secure ease of manipulation, compactness and simplicity; each part being designed so as to be commensurate with the strains to which it is subjected. The machine affords that rigidity necessary to the elimination of vibration, an important requisite in the production of accurate work and perfect surfaces.

The "Modern" is built with all of its parts extra heavy so that it is capable of handling a gang of tools of extra size and taking extra heavy cuts with ease. It is, nevertheless, easy to handle, and convenient in every detail for the operator; every handle, lever and wheel being at the operator's finger ends. Every adjustment is easily made, and every inducement offered the operator to pro-



NEW FLAT TURRET LATHE.

duce the most and best work there is in him.

The construction and extra size of parts and bearings give increased strength and additional weight in those sections usually made too light to withstand the duty required at high speeds, and the exceptionally severe strains caused by the use of high speed steel when taking heavy cuts.

The accompanying illustrations indicate the many attractive features of the lathe, and show at a glance the massiveness of the head and bed, as well as general construction. The head contains the cone pulley for driving the machine, the friction back gears and the automatic roller feed and chuck. The cone and gears give the machine twelve spindle speeds in exact geometric progression, ranging from 24 to 465 r.p.m. The bed rests on a three point bearing, is extremely deep and heavy, and crescent-shape formed and reinforced under the front spindle bearing.

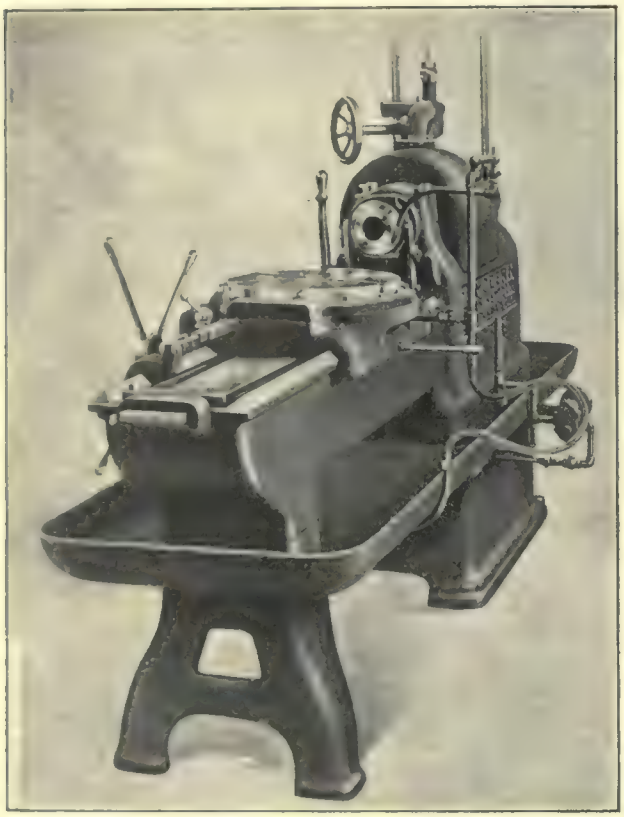
This machine is manufactured on the unit system of construction, eliminating, to an appreciable extent, individual fitting in the assembling, and insuring interchangeability of parts. Plain bearings are scraped to master surface plates and straight edges, shaft bearings are ground and fitted with suitable removable bushings, which may be replaced when worn without disturbing the alignment of the shafts, while all sliding surfaces and revolving parts are provided with liberal and efficient means of lubrication readily accessible. The belt shifter is operated by the hand wheel in front of the head within easy reach of the operator, and the motion from the hand wheel is transmitted to the belt loop through an intermittent rack and pinion. A similar device is suspended from the countershaft and operates in unison with the device on the head through the knuckle joints and connecting rod, as shown. The belt loops are so timed, that a half a turn of the hand wheel to the left shifts the belt from the larger step to the smaller step on the head, while the loop on the upper device holds the belt out of contact with the edges of the cone on the countershaft. The next half turn of the hand wheel moves the upper loop in line with the corresponding cone on the countershaft. Thus, it will be seen that one turn of the hand wheel shifts the belt from step to step in either direction.

The automatic chuck is operated by a single movement of a lever in front of the head. It has a strong and unyielding grip, no overhang, no end motion, no changing of the jaws. One set of jaws is adjustable for the full capacity of the machine. The jaws and seat are hardened and ground. This chuck is constructed for handling rough bars. The jaws are of unbreakable form and may be readily made for any size and shape within the spindle's capacity.

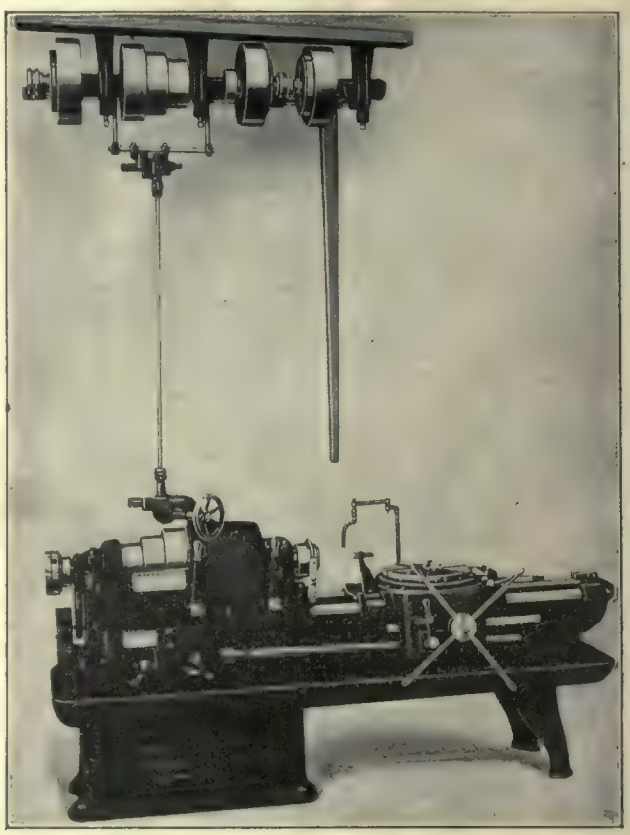
The feed gear box is driven from the spindle. Eight feeds are obtainable instantly, ranging from .005 to .085 per revolution of spindle and may be operated in either direction. These feed changes are obtained by means of the lever and crank handle shown at the front of the gear box. Motion from the feed box is transmitted through a disc friction and knuckle joint, through the carriage feed rod. The gears, cone pulley and all moving parts are enclosed to prevent injury to the operator.

The turret is 18 inches diameter, provided with (T) slots of ample proportions, thus permitting the use of substantial planer head bolts for securing the turning tools to the turret. These can be secured, one back of another, for turning several diameters at one movement of the turret, thus eliminating the objectionable stud-bolt. The index is large in diameter, the lock bolt located directly under the working tool, and so close to it, that there can be no lost motion between the tool and the locking pin.

The triple friction countershaft has pulleys 16 inches diameter for 4½-inch belt. The cone has three steps, the largest diameter being 14½ inches, carrying a 4-inch double belt. The net weight of the machine is 4,500 pounds, and the floor space 4 x 11 feet.



NEW FLAT TURRET LATHE.



NEW FLAT TURRET LATHE.

# FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

### MOULDING A JACKETTED GAS ENGINE CYLINDER.

IN the course of a paper on "The Moulding of a Jacketted Gas Engine Cylinder," given before the Sheffield branch of the British Foundrymen's Association on October 26th, Mr. J. G. Robinson, of Halifax, advocated the use of chills in making a cylinder to avoid drawn or spongy places in the casting caused by the variations in its thickness. Chills, he said, were introduced in order to close the grain of the metal and to obtain an even rate of cooling of the thick and thin parts alike. The old-fashioned foundrymen were afraid of chills, lest they should produce hard white iron and cause trouble in the machine shop; but by the judicious use of chills and a knowledge of the correct thickness to use, it was possible to obtain the effect desired. Owing to carelessness the coremakers, sometimes did not get the chills to follow one another in a circle, but if they were placed truly there should be no trouble in boring.

It was possible to get metal so hot that the mould could not stand it. The hotter, however, the metal, the more solid would be the casting. At the same time, he did not believe in casting everything as hot as the metal could be brought from the cupola. He had never known any oil-sand really to blow, and he agreed that better results were obtainable from raw than from boiled oil. The latter seemed to separate out on to the skin of the core, and produced a harder skin than did the raw material, and metal would not lie quietly on a hard surface. There was no question, however, about the saving of cost by using the boiled oil; on the class of work he had been describing, the cost of coremaking was reduced at least 30 per cent., and fettling from 75 to 100 per cent. There was nothing better than raw linseed oil, but when they considered the cost they realized that it was not merely a case of using the best material.

### EFFECTS OF REPEATED MELTING

TO ascertain the extent to which repeated melting influences the strength and reliability of bearing metals, an investigation was made by the German official testing bureau for materials, with the following results:—Alloys of copper, antimony, and tin were not appreciably affected by repeated meltings, but the rate of cooling was an important factor. Quick cooling yielded a finer grain and higher hardness and strength, and as a result it is recommended that white metals should not be heated to high temperatures, but should be cooled rapidly. Bronze, poor in tin, and therefore, comparatively inexpensive, may have the hardness and strength increased by being rapidly cooled from a temperature of 1440 deg. Fah.

### NICKEL IN CANADA.

IT is claimed that Canada possesses the key to the European naval problem," states a report. "When Schneider in 1889 introduced the use of nickel into the manufacture of steel armor plates he little realized that he was placing in Canada's hands a great means for maintaining the peace of the world. Battleships without nickel steel armor would be utterly helpless before modern guns. If nickel were no longer obtainable, armor construction would go back a quarter of a century.

Canada to-day produces about 90 per cent. of the world's supply of nickel, and practically all of the remainder comes from New Caledonia, an island in the southwestern Pacific controlled by France. In 1910 the value of nickel ore and matter exported from Canada to the United States was approximately $3,450,000. As the only refineries in America are in the United States, nearly six-sevenths of the Canadian nickel was refined to the south of the border. Consequently, if Canada were to prohibit the export of nickel, the nickel steel industries of Europe would fall into decay and high grade armor plate for battleships would be an impossibility.

### C.N.R. CAR WHEEL PLANT.

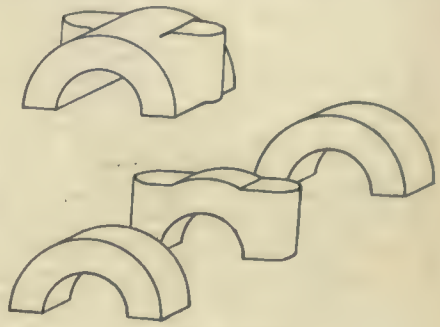
We understand that the Canadian Northern Railway are planning the erection of a Car Wheel Plant in Toronto, and that Mr. J. Kilpatrick, who recently resigned his position as general superintendent of the Canada Iron Corporation, is in charge of the project.

**Alfred Weeks**, Johnstown, P., has been appointed chief mechanical engineer of the Canadian & Northwestern Steel Co., Vancouver, B.C. Mr. Weeks graduated from the mechanical departmen of the Western Universiay of Pennsylvania, Pittsburg, in 1904, and later worked for the Cambria Steel Co., Johnstown, Pa.

### THE BUSINESS OF PATTERNMAKING.*

By James Glass, Pittsfield, Mass.

TO build correctly and quickly, which means cheaply, is a commercial necessity. The general lack of the constructive quality in workmen is best



FIGS. 1 AND 2.

known to the progressive employer, whether in the foundry or in any other industrial line of action. Nowhere in manufacturing is its influence felt and its usefulness more applicable than in the patternshop.

#### Pattern Construction.

Until recent years the patternshop has been looked upon as a semi-productive department and the patternmaker as a kind of a half brother to the artist. This attitude of the employer no doubt has brought about the present condition with its lack of individual improvement, and certainly has curtailed the patternmaker's value as a productive unit. To get at something that will be mutually beneficial to employer and employee alike we must replace the artist by the mechanic, the impractical with the practical, the

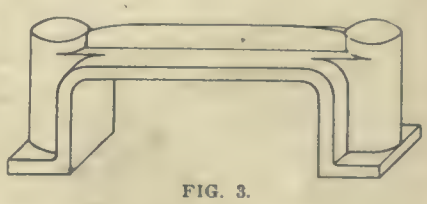


FIG. 3.

aesthetic with the constructive. Let us look along the benches in the patternshop. We find the boy or the man laboring over a drawing. He has formed correct impressions as to the general outline of the work. He has concluded as to the best method of molding, but the construction of the pattern has him guessing. This stay in the progress of oper-

*Abstract of paper read at the recent Foundrymen's Convention in Buffalo, N.Y.

ation does not always apply to a big job but very often to the small one, and the mode of construction is the determining factor in the price. How often have we heard the patternmaker say, "If I had to make that job again I would build it a different and an easier way;" but unfortunately for the employer the same design is seldom used.

I say the mode of construction on a small pattern regulates the cost, and let me give a few simple illustrations in defense of the assertion. Take a small cap as in Fig. 1. Nine times out of ten the man will lay it out on a small block, saw out what he can on the band saw, and then complete the work carving it out to the desired shape by hand. By constructing it as in Fig. 2 we take full advantage of the saw, reducing hand work to a minimum and saving at least fifty per cent. in cost.

Take another small pattern as in Fig. 3. To lay this pattern out on a piece of wood and dig out by hand what cannot be reached with the saw means labor and time; but note in Fig. 4 how near to completion it can be got by dissecting it and doing the work almost wholly with the machine. The dissecting of a small pattern to facilitate its production does not always weaken it, as some might think, but as a matter of fact more often strengthens it, and for the majority of purposes quality of workmanship is not destroyed.

In a bigger pattern, such as an ordinary bedplate, for molding purposes, durability, etc., we have decided to make a box pattern, coring out the inside. The usual mode of procedure on a pattern like this is to get out two frames (top and bottom) to the given dimensions, half lapping them at the corners, and filling in between to the desired shape and height. Fig. 5 shows how in building we may form an enlarged lap with butt joints, simplifying construction and with a noticeable saving in labor. By glueing blocks in the corners and pieces across the joints inside while building, we have a pattern capable of withstanding any kind of abuse.

### The constructive man.

These illustrations are elementary to some patternmakers, but the general need of attention along these lines is very obvious to those directly connected with the trade. I have talked of the man who makes every lick count, "the man who makes a good piece of work" with a hundred per cent. less time on it than the other men in the shop, and with seemingly less effort—he's the constructive man. This is the man we are all looking for; the kind of a workman we want to raise. This is the man who does not have to be told every move to make, who increases production and decreases the cost of supervision. In him we have the evolution of the artist in the patternshop—the builder. He is the type of workman who is always respected by the boss and admired by his fellow workmen—respected

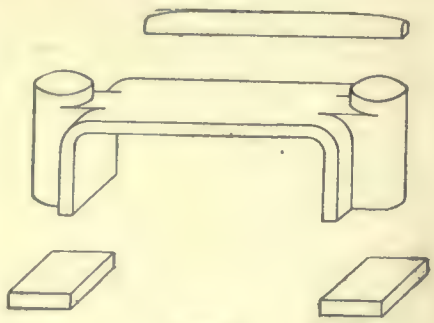


FIG. 4.

by the broad-minded foreman because of his rapid completion of the work entrusted to him, and admired by the men because he is a leader; but it is surprising how few realize and how seldom the attention is drawn to the fact that this man's master power is due to his natural or acquired constructive ability. It is oftener concluded that his qualities originated in his having worked in many good shops; yet, while moving around is

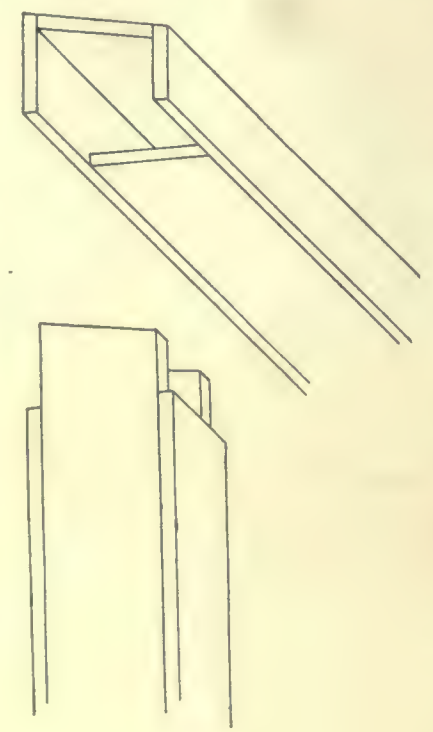


FIG. 5.

a help to the builder, adding to his confidence in generalities, it is far from being the key to his success as a workman. Some men might chase from shop to shop for a hundred years and never climb above the ordinary.

Some years ago, while working in the patternshop connected with one of our large plants, I wanted to confer with the foreman as to the method of building up a good-sized pattern and approached him with this purpose in view, but met with the response, "If you are a patternmaker you ought to know." It was this indifferent attitude of one whose position warrants assistance rather than rebuff that made me seek the society of Mr. Construction, and believe me he is the most willing and most able consulting engineer of my associates.

"The art of patternmaking!" Why, art is a disguise to talent, taste is the foundation of art, constructivity is a creation of the mind, a ramification of thought. We take our place in the industrial field according to our constructive ability—nations, as well as individuals. Jas. Naysmith, through his study of Euclid (mathematics) developed his steam hammer. The foundryman's success is due to an efficient business structure; the scientist's achievements to synthetic atomic and molecular work on stable and unstable compounds.

### The Patternmakers' Outlook.

The patternmaker is apt to be looked upon by the manufacturer as artistic—a kind of a luxury; yet the patternmaker of the future must and is going to have a different place in the industrial arena. With a constructive training, his opportunities for promotion never were brighter, for through specialization in the other departments, the sources from whence the bigger men were drawn have been partially destroyed, and the employer will look more to the patternshop for this supply. Some patternmakers are alive to this fact and are preparing themselves for it, as is very evident from the number we see as foundry foremen, superintendents and incumbents of other responsible positions. The manufacturer is giving every indication of encouragement. He is taking him out of cellars and attics and providing him with comfortable quarters, he is organizing industrial schools for his benefit, he is saying to the patternmaker—"there is the foundation—build." Constructivity, when the seeds are properly planted, is both interesting and fascinating. It teaches resourcefulness and is a developer of originality. It attracts and it leads, and is a pleasurable means to a profitable end.

Should you find your pattern production lagging and are at a loss how to stimulate activity, before applying the megaphone method, thereby spreading a discordant feeling among the men, ascertain if a decided change cannot be made in the mode of "construction."

## IRON AND STEEL PLANT, ST. JOHN, N.B.

THE proposed iron and steel plant and other developments for the city of St. John came in for discussion at a recent meeting of the Provincial Government, when requests were made for Government assistance in carrying the projects to a successful issue. Messrs. W. H. Thorne, president of the Imperial Dry Dock Company, and W. Burton Stewart and J. R. Stone, directors, were present at the meeting, and told of the proposed development. Mr. Stewart spoke at length on the importance of the iron and steel plant to the city of St. John and the province generally. He asked that the government, with the city of St. John, guarantee the amount of the sinking fund for the redemption of the bonds, should the annual earnings of the company be not sufficient to put aside one per cent. for such purpose.

The government gave the members of the Dry Dock Company assurance that their requests would be considered as early as possible.

At the conclusion of the conference, Mr. Stewart, who is the general manager of the Norton Griffiths Co., expressed himself as highly pleased with the reception tendered the delegation by the members of the Government. The object of the assistance from the city of St. John and the government, he said, was to enable the company to secure a site for the iron and steel plant, which would involve an expenditure of between two and three thousand dollars in its establishment and would afford employment to between a thousand and two thousand men. The company would require to put aside $48,000 a year towards a sinking fund.

Before taking definite action in the matter it is expected that the government will meet with the city commisioners of St. John relative to the matter.

## CANADIAN CAR & FOUNDRY CO.

THE report of the year's operations to September 30 last, which will be presented at the annual meeting of the shareholders of the Canadian Car & Foundry Co., on December 12, is understood to be very favorable. The last annual report showed net profits of $1,007,138, from which were deducted $385,000 for preferred dividends, leaving a balance of $622,138 available on the $3,875,000 of common stock equivalent to 16 per cent., and from which a dividend of 4 per cent. was declared.

At the close of the fiscal year September 30, 1911, the unfilled orders on the books of the company amounted to over $5,000,000; on November 30, 1911, they were approximately $10,000,000, but on account of the severe depression in the United States, and resulting competition for Canadian business, many of these orders had to be taken up at rock bottom prices, so that profits on this year's operations will be curtailed although offset by the larger volume of business.

### 18 Per Cent. on Common.

"The amount that will be shown for the year 1912," says the Financial Times, "can be stated on good authority to be in the neighborhood of 18 per cent. on the common stock, after providing for interest, preferred dividends and liberal appropriations. The fixed charges are increased by the addition of $1,100,000 six per cent. bonds issued recently to finance additional plants and extensions.

"The management, having announced that it intended to pursue a conservative policy by strengthening the reserve funds, declined last year to accept the suggestion of some shareholders that quarterly dividends be paid instead of semi-annually, and adhered to the policy of declaring the amount of dividends to be paid on the common shares after the year's net results are known. In view of the large amount of construction being done by the company to cope with the ever growing demand for equipment, and to offer effective competition to the numerous car companies formed this year, it is generally understood that no change from the half-yearly payments of two per cent. will be declared at the coming meeting, nor is any increase expected during the early part of the new fiscal year."

## PIECE WORK.

Mr. T. F. Keane, in speaking before the Master Blacksmiths' Association recently, dealt with the advantages of piece work over day labor. He said: "With piece work a man's ability is accurately known. The men will not only apply all their skill in doing the work, but they will improve their output and learn better and more efficient methods of handling their tools, so that they may work them up to greater capacity. The output can be increased and also better work turned out if the same kind of work is always given to the same man, as men constantly employed on the same kind of work will become more efficient.

Cutting piece-work prices shows great ignorance and inexperience on the part of a piece-rate man, because it is a sign when some men make more money on their piece-work, that they are taking an interest in their work, and are hustling and working more efficiently. If their work is done properly they deserve all the money they can make. The chances are that if another man was put at the same work he would not be able to make half as much. A man should understand that the price set on a piece of work is satisfactory to the employer, provided, of course, that it has been set properly in the first place, and that what the employer wants first of all is production.

It pays the employer to treat the men with consideration and investigate their complaints, if any are made, and it may be necessary at times to raise a price to take care of certain unforeseen conditions on account of the hundreds of little things which have to be considered. If everything is given proper consideration there is no reason why the straight piece-work system should not be looked upon with favor by the employee, since through it he can make more money.

## INDUSTRIAL DISPUTES.

THE annual report of the Department of Labor, Ottawa, for the year ended March 31 last, has been issued. Probably the feature of it in which most people are interested is the operation of the Industrial Disputes, or Lemieux Act.

The number of industrial disputes generally reported for the calendar year 1911 is somewhat above the figures reported for the previous year, being 97 as against 84. The strikes were chiefly of the smaller order, and the record of the year as to actual loss of time and other matters would have been particularly pleasing, but for the prolonged Western coal strike. The strike total for the year 1911, however, though higher than for the few years immediately preceding, is very much below the record of nine or ten years ago; in 1902, for instance, the total for the year was 123, and in 1903 the figures stood at 160.

Having in mind the large increase of population during the intervening period, the present record would seem to show some improvement of feeling as between employers and employees. Of the 97 disputes of the past year, the building trades were responsible, as usual, for a larger proportion than any other single group of industries; disputes in the building trades having totalled 30 for the year. The groups of industries coming next in order were the metal workers, clothing trades and transportation industries.

**E. H. Mumford**, of the Mumford Molding Machine Co., Plainfield, N.J., addressed the New England Foundrymen's Association on November 13, his subject being "Recent Phases of Molding Machine Development."

# The "Bawden" Steam Pump

By Calliope.

THE Bawden'' steam pump being manufactured in Toronto by the Bawden Machine Co., Toronto, embodies in its design many features of interest to power plant engineers and those connected with steam and hydraulic installations generally. It is the outcome of 24 years' practical experience of steam pump design and manufacture, and presents, as its leading feature, simplicity of detail. The Bawden Machine Co. have secured the patent rights together with the services of Mr. Attwood, the patentee, whose record and extensive experience of pumps generally reflects success for this new achievement in the Canadian power field. The writer had the pleasure of seeing a trial pump in action, and, needless to say, was favorably impressed with its work.

The main idea, that occurs to one on close examination of the design and constructional detail are the concentration of effort apparent in furnishing the operating engineer with a simple and reliable mechanism, whose individual parts are easily accessible, thereby avoiding long delays for examination and repairs; and the subdivision of these parts so as to reduce cost of renewals in case of accident by frost or otherwise.

**Detail of Construction and Operation.**

The "Bawden'' pump is governed by two piston valves which are a ground fit and are controlled by the action of live steam only. All tappets, levers, springs, rock shafts, tubes or other extraneous gear are dispensed with. A special feature of the piston valves is the arrangement for catching leakage of steam due to wear and tear, thus preventing the valves from getting into equilibrium at their driving ends, and resulting in a longer period through which they will work without repair. The steam piston is automatically cushioned at each end of the cylinder by a special design of the two main steam ports, dispensing with all adjusting mechanisms. There are no dead centres and there is no tendency to hang up. Claim is made also that it cannot be held up. It will run under full load at the fastest and slowest speeds, thus providing the engineer with a flexible pump for all purposes. The firm are making three types which are illustrated by the accompanying cuts:—

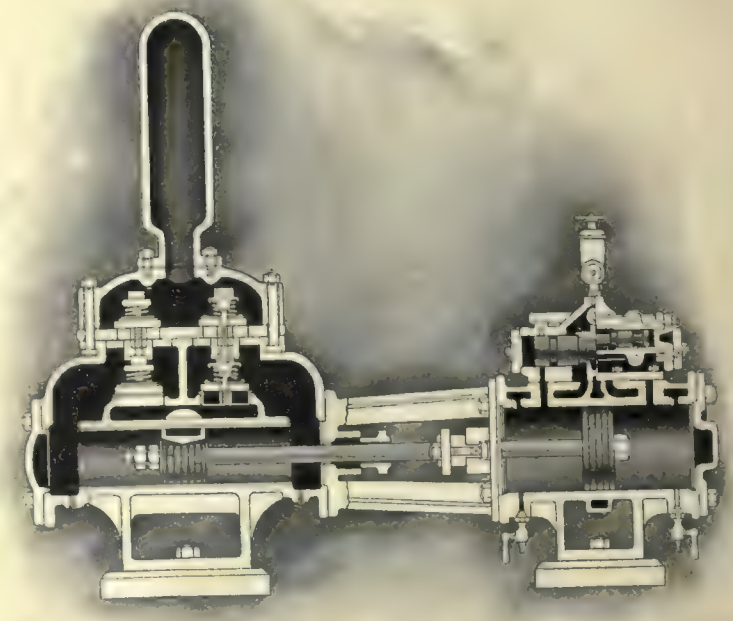


FIG. 1. THE "BAWDEN" PUMP FOR MODERATE PRESSURES AND VACUUM SERVICE.

Fig. 1 represents the regular line suitable for moderate pressures and vacuum service. These have packed water pistons, brass liners, and valve seats which are driven into taper seats and held in with brass stoppers accessible through handholes.

Fig. 2 also represents a pump with packed pistons but with outside valve boxes containing the water valves, each one accessible by removing top cover. This pattern presents special features, as all parts subject to pressure are cylindrical and consequently of great strength. In addition to the cost of renewals being less expensive, and the saving of time in examination and repairs, obstructions in valves are easily located and removed without disconnecting water pipes.

Fig. 3 shows the centre packed ram series, an attractive type for all high pressure work. This pattern favors a short stretcher, the piston rod is cottered into the ram and the valve boxes are bolted to the working barrels, a combination of good features, enabling pump valves to be easily examined, and leakage by packing glands to be always visible. All parts subject to pressure are in this type also cylindrical, consequently it has the advantages enumerated for Fig. 2.

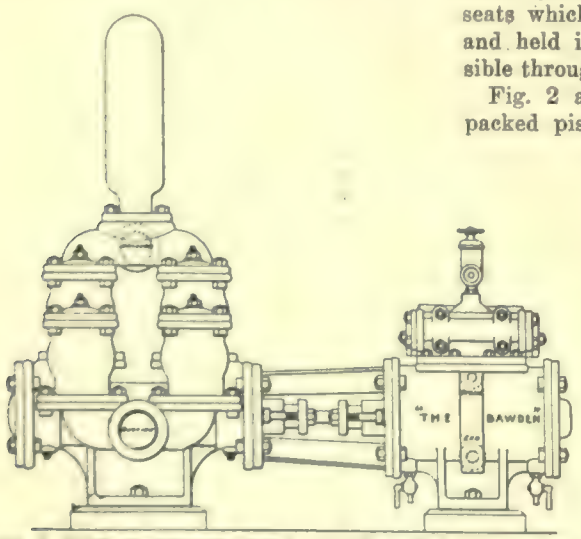



FIG. 2. THE "BAWDEN" PUMP WITH PACKED PISTONS AND OUTSIDE VALVE BOXES.

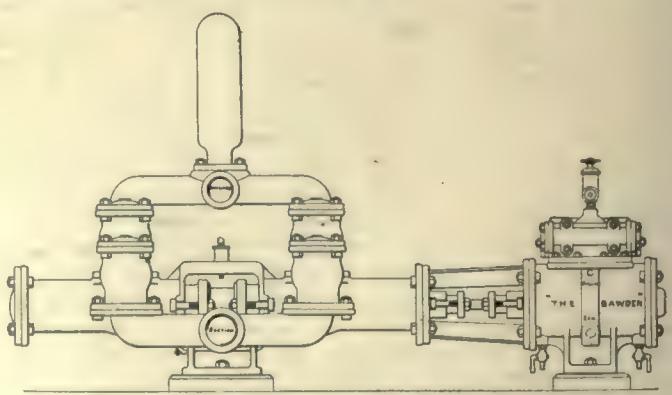



FIG. 3. THE "BAWDEN" CENTRE PACKED RAM PUMP.

In a conversation with Mr. Attwood we learned that his valve motion is equally satisfactory on compound cylinders of his design, and that in the near future we will have the opportunity to illustrate this type for boiler feeding and other purposes. The "Bawden" pump is especially adapted to general marine service, among many reasons being the absence of lever valve motion enabling the longest stroke pump to be used, a consideration which every engineer knows to be the best for producing the highest and most constant vacuum at moderate piston speeds.

**The "Bawden" Compound Pump.**

Where greater economy of steam is desired, compound pumps embodying the same valve gear as used on the simple units, are of course recommended. The high and low pressure pistons work in one cylinder, the steam and exhaust ports being of the shortest possible length and so arranged that the high pressure steam never leaves the cylinder casting, while exhausting into the low pressure cylinder. There are no external passages, therefore, radiation and condensation are reduced to a minimum. Only one steam chest is required with one valve to distribute the high and low pressure steam, the whole forming a most compact, reliable and economical pump for boiler feeding, fire service and general purposes. The "Bawden" compound pump will run at speeds varying from the very slowest to the fastest without any mechanical adjustments for cushioning the pistons.

# What Education Means in Accident Prevention

By M. W. Mix

*The writer of this paper shows the lack of universality of effort towards accident prevention; the movement being, as yet, confined to large manufacturing corporations only. Needless to say, he points out the urgency that exists for the smaller concerns being brought into line on this vital question.*

WITH the development of the new doctrine of indemnity in the case of occupational accidents, which disregards the assumption of risk and negligence as defenses to the employer, it becomes necessary to consider the question from a purely educational standpoint, establishing collaterally therewith the doctrine of prevention of accidents. In nearly every large establishment, some special thought is being given to the safety of employes, and as a result, these employes are becoming aroused to the necessity of looking out for their fellow-workers and themselves.

**Fundamental Reasoning.**

The average individual at work for himself or in the pursuit of his own happiness, will take more chances with his life and limb than are necessary for him to take, even with the state of protection as it stands to-day, and there will be no change in this popular disregard for personal safety until there is an established public conviction, an active, yet sub-conscious state of mind that automatically thinks of "safety first." No employer designedly exposes his employes, and on the other hand, it may be said that few workers purposely put themselves in harm's way.

Years of education and sad experience have taught even the most heedless of men, owning property, that it pays to prevent fires. Such precautional measures with reference to fires are second nature to most people, and the same thought must be created in behalf of accident prevention. Again, the same relation must exist in all minds, with reference to accidents as exists with reference to contagious diseases. It will, however, be the work of a generation and perhaps two generations to bring every one to this state of mind. The education should commence from the cradle, be carried through the public schools, and then to the occupational field. All classes must be made to recognize its force from a standpoint of preventing waste, just the same as sickness is now being regarded. There will always be indifference, yet this may be largely overcome if the teachings are sufficiently impressive and started early in life. It is a case of drill—drill—drill.

**The Movement not Sufficiently Comprehensive.**

Just now the railroads, mines and manufacturing establishments are receiving the principal attention of the Social Welfare workers, but with this doctrine recognized as one of universal responsibility, it means that the entire public will be affected and must become aroused to the importance of a wise and equitable basis for dealing with the situation. Heretofore, such employers as agriculturists and horticulturalists; the small tradesmen, such as building contractors, involving a variety of craftsmen; employers of domestic labor, etc., have given but little heed to the progress of this question, yet it goes without saying that they will eventually become involved in its workings, because, man for man employed, or dollar for dollar of wages paid, the aggregate of these employments far exceeds those of the factories, and there can be no doubt of their ultimate responsibility under any Employers' Liability or Workmen's Compensation Act.

**General Trades Lacking in Workers' Protection.**

In none of these trades or occupations are there the same elements of protection to the workers, as in a well organized factory. Take the farm for example:—The machinery is more dangerous than factory machinery, the work conditions are more hazardous, man for man, and less attention is paid to the prevention of accidents. There is also lacking the fine discipline of an organized factory, and men take more personal chances every day. In Germany, statistics show that nearly 45 per cent. of the occupational accidents are in agricultural and horticultural pursuits, which demonstrates beyond doubt, the need for covering this field in all general relief measures. The same criticism as to exposure and protection may be made of the minor trades, where the number of employes per establishment is small and supervision is uniformed and correspondingly limited.

**Hardship to Small Employer.**

The working of the present laws, in a number of States, attaches a serious burden to the small employer, and it is, in fact, becoming a hardship for him to get labor on account of the lack of responsibility in case of accident, and this condition will be accentuated as time goes on. Insurance of some kind must be provided wherein the individual risk will be spread over the entire trade and be made compulsory. There can be no separating of the sheep and the goats, they must all go together, or the doctrine will fall of its own weight. It must be evident, therefore, that all hands must be "piped on deck;" all must become fully informed on this subject, and there can be no valid excuse to justify a lack of interest on the part of any employer or worker, else there may be a condition brought about that may throttle our very industrial life. This question may be first solved with such a vengeance that the much lauded system of protective tariff for infant industries would pale into insignificance, as against the protection that small employers may need under an extremely paternalistic solution of the occupational accident question.

**Highly Developed Factory Inspection Required.**

In addition to a national campaign of education, what is now needed, is a uniform nation-wide standard of protection to workers in the various lines of

employment, and coupled with it must be provided a highly developed form of standard factory inspection with appropriations of sufficient size to insure competent and ample assistants, and provision for complete statistics on all work accidents. At the present time, we must work more or less in the dark until proper standards are established, yet we may, meantime, receive much information from Germany, where are maintained as public records, full statistics on all trades and in all sub-divisions of the Empire. German standards of protection may not be suitable for us, but they may at least form a basis from which our own standards may be developed to suit our particular conditions, both in individuals and in occupational environment.

Warnings have been sounded against our going to extremes, and it not infrequently happens that after so much agitation, we may quickly adopt the principle and swing the pendulum so far to the opposite side that it may result in outraging a large number of dependent, thoughtless workers who have never been in the habit of exercising their faculties. Hardships are best endured by those who have had experience and to those who have never experienced danger, nothing seems dangerous. The Manufacturers' Bureau of Indiana has given much time and thought to accident prevention and workmen's compensation, and it firmly believes that any movement that does not include all employments will eventually fail, and that the greatest relief will be found in inaugurating a campaign of education throughout the State on accident prevention, and requesting a more complete system of State inspection and statistics than we now have, covering all employments, regardless of size or kind.

**Dodge Mfg. Co. Plan.**

In order to bring this matter of safety directly to the employes of the Dodge Manufacturing Co., the management has prepared a plan of education and competition between departments and their foremen. This is in the line of a percentage score board, such as indicates the standing of teams in the baseball leagues. The starting point is 1,000 and each division is penalized according to its accidents—minor accidents of less than one day's absence not as yet being considered. Each day's absence bears a percentage charge in proportion to the total number of men—days per month in each division. The foremen of all of the divisions scoring 1,000, or those holding the first three places below 1,000 will receive prizes of personal interest each month. The foreman scoring the largest number of first monthly prizes for one year, will receive a special prize at the end of the year. All divisions holding a percentage for the year of 1,000, or the highest annual percentage, will receive two days' full pay as a reward for their good record, and the second highest will receive one day's pay extra.

The plan is in rather a crude form at present, but it will be of daily interest, because of its competitive nature, and will facilitate the inculcation of preventative measures and of individual care and forethought, as well as speedy and prompt attention to reduce the severity of the accident and shorten the time of absence. At all events, the interest in the daily score board, which is 24 feet long, and erected at the main works' entrance, will afford a splendid vehicle for carrying influence to the worker. Each week also a spirited or expressive motto will be placed at the head of the board that is bound to have an excellent effect on the daily thoughts of the workers. The slogan must be—"Education" in order to produce in the individual mind an automatic, sub-conscious, ever-present thought to "look out for yourself first and the other fellow always."

Safety committees are good things, but they do not go far enough. They must educate the worker, the foreman and the official. All must be thinking of the subject: every individual must be a committee unto himself, and do so from the standpoint of a real interest in preventing accidents, stopping waste, avoiding suffering and disability to his fellowmen. When the whole factory or the whole field of workers will so regard accidents, the problem will have been solved. In the language of a famous advertiser—"Eventually, why not now?"

The foregoing is a reprint of a paper read before the Conservation Congress at Indianapolis recently by Mr. M. W. Mix, President of the Dodge Manufacturing Company, Mishawaka, Ind., and made available to us through his courtesy.

## MANUFACTURING TERMINAL FOR MONTREAL.

A SYNDICATE has been formed in Montreal for the purpose of constructing a manufacturing terminal on a piece of land, about 16 acres in area, lying between Notre Dame street east and the river front in Longue Pointe ward. The property has a deep water frontage of 1,200 feet. A Federal charter has been applied for by the syndicate, which is to be known as Manufacturers' Terminal, Ltd. The authorized capital will be seven million dollars.

The scheme is to first of all construct four buildings, each four to five hundred feet in length by one hundred and fifty feet wide, and six storeys in height, with double track spurs running into each building unit, and thus, through the Harbor Commissioners' Railway, connecting with every trunk line railway in the Dominion, and with a dock and piers for the accommodation of ocean-going vessels. Each building will contain an area of about 400,000 square feet, or a total in the four buildings of 1,600,000 square feet. Floor strength and all handling equipment will be designed to meet the requirements of heavy products. Space, including heat and elevator service, will be let at rates which will be less than it would cost the individual manufacturer were he to own his own property. The buildings will be absolutely fireproof and of the most modern design and construction.

## A NEW ZINC BRONZE.

THE great strength necessary for bronze used in the construction of machinery, the keen competition existing between manufacturers, and the wide fluctuations in the price of tin, have induced metallurgists to study the question of substituting for the rather expensive tin bronze some special brass compositions (so-called zinc-bronzes), which not only have the advantage of being cheaper, but also, by far, surpass the tin bronze, so far as the breaking strength and elongation quality are concerned, at the same time offering the same resistance to attacks by acids.

As the result of a series of systematically conducted researches, the foundry laboratory of the Engineering Works of Escher Wyss & Co., Zurich, Switzerland, has succeeded in producing a zinc bronze, "Universal Bronze," which, besides being one of the most simple compositions imaginable, possesses a remarkably great breaking strength and tenacity, without presenting the disadvantages outlined above. Tests carried out during the last three years have shown this material particularly suitable for the construction of runners and impellers of pumps and turbines exposed to the wear and tear of high speed water or impure liquid or acids.

At the engineering works of Escher Wyss & Co., at Zurich, Switzerland, and at Ravensburg (Wurtemberg), "Universal Bronze" has been used on a large scale for several years in the manufacture of every kind of machinery parts exposed to heavy and sudden stresses, such as wedges, bearings, bushes, valves, stuffing boxes, screws, screw-heads, wings of propellers, runners for turbines, turbo-pumps, etc. Particularly in the construction of turbo-pumps for raising impure water or acids this new bronze has been a success.

The head office for Canada of Escher Wyss & Co. is at 514 Canadian Express Building, Montreal.

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Write or phone for full information, and if you desire it ask for an estimate on equipping your building.

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# STEEL CASTINGS

Acid Open Hearth Steel for Locomotive and Machinery Castings.

Stock Process Steel for Automobile and Light Castings of all descriptions.

## Our plant will be in operation early in October.

**(Annual Capacity, 12,000 tons.)**

***Let us figure on your requirements.***

## The Dominion Steel Castings Company, Limited

HAMILTON, ONTARIO

# INDUSTRIAL AND CONSTRUCTION NEWS

## Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

### FOUNDRY AND MACHINE SHOP.

**Toronto, Ont.**—Mr. Gordon Perry, manager of the National Iron Works Company, has awarded a contract to Mr. John E. Russel for new buildings for extension to their cast-iron pipe foundry at Ashbridge's Bay. The new buildings will more than double the capacity of their plant, and the total cost will approximate $300,000. Work will be started at once.

**Owen Sound, Ont.**—The two new buildings for the Canadian Malleable Iron Co. are now under course of erection, and work is being rushed ahead as fast as forty or fifty men can accomplish it. The site selected is ideal. The old tramways of the Carney Lumber Company run east from the mill, then north and westward out towards the lake. The rectangle thus formed encloses a space of about six or seven acres and it is within this that the new plant is being built. The first unit is just north of the tramway running out from the mill. This building is 250 ft. in length and has a width of 80 ft. The foundation has been dug out and the concrete for the first course has been dumped in. The second unit lies to the north-west of the first building and will be the same size as the other. Thus, the two buildings will almost touch corners, being placed practically end to end and both running approximately east and west. It speaks highly for the energy displayed by Mr. H. A. Gutenkunst and the Raulf Construction Company's superintendent that, despite the vile weather conditions, such good progress has been made on the new plant. Given weather that is in any degree favorable the desire to have the buildings walled in and roofed by New Year's will be realized.

**New Hamburg, Ont.**—The Electrical Utilities Co., Toronto, Ont., has its new buildings at New Hamburg, Ont., nearly completed. The plant will include a brass foundry, iron foundry, machine shop, electro-plating and woodworking departments. Complete equipment will be required. James Fowler is president, and R. F. Smith, secretary.

**Sutherland, Sask.**—An arrangement has been come to whereby a company, known as the Saskatchewan Foundry & Iron Works, with capitalization of $50,000, will locate here. Soil pipe will be a special feature of the products, while general castings will, of course, form a large part of the output.

**Guelph, Ont.**—The erection of the Malleable Iron Works is nearly at a standstill because the Works Commission has failed to put the roads leading to the site in proper shape for traffic. The wet weather has made it impossible to haul heavy material for building purposes, and the commissioners are blamed for dilatoriness. The Guelph Stove Co. also complain, stating that the transportation companies have refused to send teams under present conditions.

**Regina, Sask.**—The Emerson Plow Co., of Rockford, Ill., are about to locate here. A property has been purchased and arrangements have been made for its adaptation to this particular business. Alterations are expected to be completed in about four weeks. The firm will carry a full line of tractors and farm implements.

**Portage la Prairie, Man.**—Announcement has been made by the secretary of the Board of Trade to the effect that the Economy Foundry Co., of Winnipeg, would be in operation shortly. It is understood that the company will not only repair machinery, but manufacture all kinds of castings, including builders and structural castings. A by-law was recently approved by the ratepayers, granting to W. J. McMartin, of Winnipeg, who is at the head of the company, partial exemption from taxation for a period of 20 years.

**Edmonton, Alta.**—There has just been shipped to Edmonton for the Portland Cement company over the Grand Trunk Pacific from Alliance, Ohio, en route for Marlboro, Alta., the largest plant of its kind in the Dominion. This includes three rotary kilns, each 140 feet long and eight feet in diameter, made of steel ranging from three-quarters to fifteen sixteenths of an inch in thickness and weighing 150,000 pounds exclusive of base and gear. Twelve flat cars, six of which carried the ends of the kilns on swivel blocks were required to convey the machinery whose total weight was 450,000 pounds. Before undertaking its delivery the railway company had men at work carefully checking the track curves and bridge clearances to make sure that there would be no obstacles. Altogether 300 cars of machinery and material have gone to build up the plant which will have cost $650,000 by the time it is running. This, it is hoped, will be early in January, when 1,500 barrels of cement will be turned out daily, the company having marl and clay supplies enough to last for at least forty years.

**Moose Jaw, Sask.**—The concrete foundation for the new general offices of the Saskatchewan Bridge and Iron Co. on Second Avenue, have been completed and the upper structure will be commenced in a couple of days. The building will have a frontage of some 90 feet on Second Avenue and will run back 24 feet to the wall of the iron shop. On the ground floor will be located the executive offices of the company while the upper storey will be the draughting rooms and designers' quarters.

**Hamilton, Ont.**—It is understood that the Canadian Roll and Machine Co. will erect a factory here. The Company is capitalized at $500,000, and proposed to spend $100,000 on the plant.

**Davidson, Sask.**—A new machine shop is about to locate here. Henry Nuessgen and Max Schroen propose to start business in the blacksmith shop recently owned by Messrs Allen & McNeil, as soon as the lathes and other machinery can be shipped.

### MUNICIPAL.

**Wadena, Sask.**—A by-law has been passed by the burgesses here for the purpose of raising $20,000 as cost of the installation of an electric light and power plant.

**Winnipeg, Man.**—The ratepayers recently approved of a by-law granting $500,000 for the purchase of a site for the new exhibition building.

**Windsor, Ont.**—By-laws were recently passed by the Council authorizing the purchase of a fire engine at $12,500 and to grant the usual exemptions to the Leggett and Plott Spring Bed Company.

**Humboldt, Sask.**—The electric light and street grading by-laws both received the sanction of the ratepayers recently.

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## Trade Gossip

**W. D. Beath & Son,** makers of cranes, hoisting machinery and interfactory transportation systems, Cooper Ave., Toronto, are extending their machine and structural shops in order to handle the increased volume of business in the heavier lines of equipment which they are making. It is their intention to greatly broaden the scope of engineering work undertaken, specializing in overhead transportation systems for foundries and machine shops.

**The General Supply Co., of Canada, Ltd.,** with head office in Ottawa, and branches at Toronto, and Winnipeg, have recently secured the Canadian agency for "Toledo" tool steel, of which John Henry Andrews & Co., Sheffield, England, are manufacturers. From what we have been able to learn of this specialty, its worth will appeal to a wide circle of users, and backed by the enterprise of the G. S. Co., it cannot fail to become exceedingly popular.

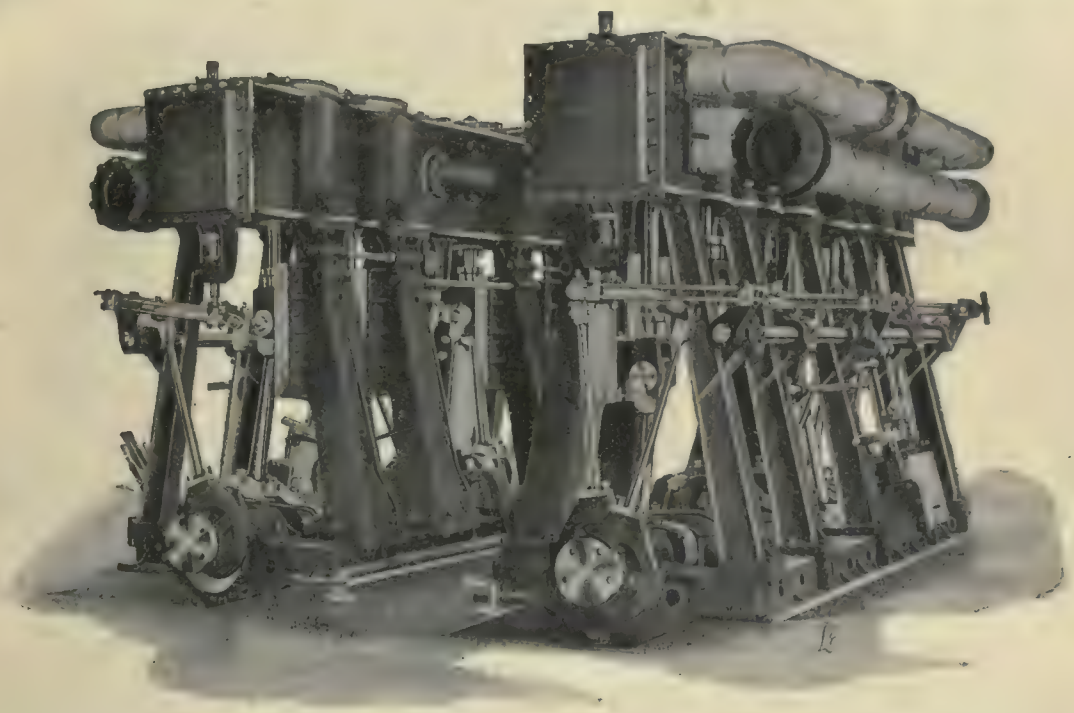
**The Canadian Porcelain Co., Ltd.,** has been incorporated with a capital stock of $300,000, to manufacture vitrified white porcelain for electrical and other purposes. They have purchased a 20-acre site in Hamilton, Ontario, and will put up a plant, the first unit to cost $150,000. The buildings will be of steel and brick and will be ready for operation next Spring. George Alden, Chas. Palmer, of Rochester, and Fred. D. Palmer, of Galt, Ont., are the principal directors.

**The Skinner Chuck Co., New Britain, Conn.,** has acquired the planer chuck business of the Francis Reed Co., of Worcester, Mass., and has moved the stock of finished chucks and patterns to the plant there. The Francis Reed Co. manufactures a line of improved drilling machinery and had manufactured the Jordan planer chucks for upwards of twenty years, but, wishing to concentrate its efforts on the manufacture of drills, disposed of its chuck business to The Skinner Co., who already manufactured a similar line of chucks.

**The Smart-Turner Machine Co.,** Hamilton, Ont., have recently secured the following orders:—The Standard Steel Construction Co., Welland, Ont., Duplex Double Acting Power Pump; Wm. Bermingham, Goderich, Ont., Duplex Pump; The Chipman Holton Knitting Co., Hamilton, Standard Duplex Pump; Pratt & Whitney Co., Dundas, steam pump; National Sand & Material Co., Welland, Ont., Standard Duplex Pump; The St. Lawrence Paper Co., Single ActingTriplex Stuff Pump; Standard Chemical & Lumber Co., South River, Ont., Duplex Pump.

**The H. Mueller Mfg. Co.,** Sarnia, Ont., will shortly begin operations. The site comprises 73 acres and the buildings in course of erection include a foundry, 60x190 feet, and a brass finishing department, 60x256 feet. Mr. Richard Lau has been appointed foreman of the foundry and Mr. W. C. McIntyre has been appointed superintendent of the plating and polishing department. The officers are as follows: O. B. Mueller, president and general manager; C. G. Heiby, vice-president and superintendent; Adolph Mueller, treasurer; and Fred. L. Higgin, secretary, assistant treasurer and general manager.

# ENGINES AND BOILERS



Marine Engine built for the R. & O. Nav. Co'ys Steamer "Rapids Prince."

We make Boilers of every kind for any service.

Engines, Pumping Machinery and heavy Plate work.

"Inglis" indicates the best in Quality, Design, and Workmanship.

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**THE JOHN INGLIS COMPANY, Ltd.**

**Engineers and Boilermakers**

**14 Strachan Ave., Toronto, Canada**

*The advertiser would like to know where you saw his advertisement—tell him.*

# Not an Enterprise for the "Quitter"

¶ "If there is one enterprise on earth," says John Wanamaker, "that a 'quitter' should leave severely alone, it is advertising. To make a success of advertising one must be prepared to stick like a barnacle on a boat's bottom.

¶ "He must know before he begins it that he must spend money—lots of it.

¶ "Somebody must tell him that he cannot hope to reap results commensurate with his expenditure early in the game.

¶ "Advertising does not jerk; it pulls. It begins very gently at first, but the pull is steady. It increases day by day and year by year, until it exerts an irresistible power."

**Sarnia, Ont.**—The burgesses here have expressed themselves in favor of the by-laws to raise money for the cost of the waterworks system and to improve the market place.

**Summerland, B.C.**—It is proposed to submit a by-law to the burgesses soon to authorize the raising of $110,000 for irrigation and domestic systems.

**Rosetown, Sask.**—By-laws are about to be submitted to the ratepayers for approval to provide funds for a hospital and an electric lighting system.

**Haileybury, Ont.**—Owing to the fact that by-laws No. 350 did not receive the endorsement of the Ontario Railway and Municipal Board, it is now proposed to submit the same by-law to the burgesses. The said by-law calls for the issue of debentures to the extent of $20,000 for the purpose of improvement of water system.

**Scott, Sask.**—The town council has decided to submit to the ratepayers shortly a by-law to authorize the issue of debentures for $14,000 for the completion of the water and light systems.

**Fort William, Ont.**—The council has passed two by-laws : To raise by way of debentures $50,000 for electric light and telephone extensions, and to expend $80,000 for sewage system.

**Penticton, B.C.**—By-laws providing for the raising if $60,000 for the erection of a new school and to build sidewalks were recently passed by the qualified ratepayers.

**Calgary, Alta.**—The council recently passed the sewerage by-laws and also gave the third reading to the intake by-law, to cost $90,000.

**Rapid City, Man.**—The by-law providing for the issue of debentures to the extent of $12,000 for the erection of a complete electric plant received the endorsement of the ratepayers.

**Sarnia, Ont.**—The citizens have expressed themselves in favor of the by-law calling for the raising of $4,000 to cover the cost of waterworks improvements.

**Preston, Ont.**—The by-law to raise $25,000 as a loan to the Anchor Bedding Company received the endorsement of the ratepayers.

**Cannington, Ont.**—The ourgesses expressed themselves in favor of the by-laws to raise money to purchase power from the Hydro-Electric Commission.

**Humboldt, Sask.**—The burgesses here have passed two by-laws providing for the raising of $30,000 for electric light purposes and $3,000 for street grading.

**North Battleford, Sask.**—The school board here propose to borrow $8,000 to be used in installing waterworks, electric lights, and other conveniences in the schools, thus a by-law to raise said sum is contemplated.

**Rainy River, Ont.**—It is proposed to submit a by-law to the qualified ratepayers to raise by way of debentures $1,500 as cost of waterworks system.

**Rosthern, Sask.**—The town solicitor has been authorized to prepare a by-law to be submitted to the people calling for the raising of $250,000 for cost of installing waterworks, sewers and an electric light plant.

**Prince Albert, Sask.**—It has been found necessary to submit again the by-law whereby $775,000 is to be raised for power development purposes. The above by-laws were passed last August, but owing to slight technical error are ruled as void.

**London, Ont.**—The burgesses will be called upon to sanction a by-law calling for the raising of $25,000 as a loan to the Finlay Electric Porcelain Company, which will establish a factory, to be the only one of its kind in Canada.

**Windsor, Ont.**—The people may be called upon to vote on a by-law to raise $20,000 to furnish machinery to enable the electric plant to comply with the demand made upon it.

**Peterborough, Ont.**—A by-law is to be prepared by which it is proposed to raise $10,000 to cover the cost of constructing an incinerator for the disposal of garbage.

### ELECTRICAL.

**Wilkie, Sask.**—The town has just had electric lighting installed and as a result the business places and streets show the improvement.

**Kingston, Ont.**—It is felt here that more power is needed and a committee is at work upon the question of making a deal with J. M. Campbell for the supply of 500 horsepower from the falls at Kingston Mills, the rate being three-quarters of a cent per kilowatt hour, or $17.50 per horse-power.

**Toronto, Ont.**—It has been announced by the Vice-President of the Canadian General Electric Company, of Toronto, that this company will, within five months, erect an office and warehouse to cost $135,000. The building will be of red brick and cut stone, and will be four storeys high. The company is capitalized at


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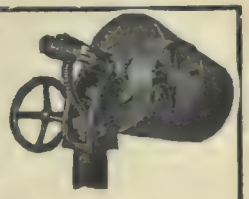
in a Globe improved Tilting Tumbler and get finest results, quickest and cheapest. It is made in six sizes for all purposes for wet or dry work.



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The IMPERIAL CHUCK

Send for a free 30 day trial order, as we want you to prove the efficiency of this reliable CHUCK

Try the Imperial Service

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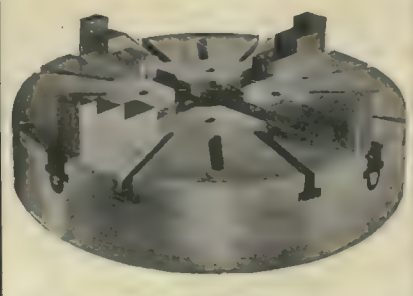

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Why continue using other brands when the best is procurable?

The best file is the most economical in the long run, because it increases the quality and quantity of your output and lasts longer.

If you are not using the "DELTA," get one from your dealer. Every dealer is authorized by us to give any customers back the price paid if the file is not exactly as we claim.

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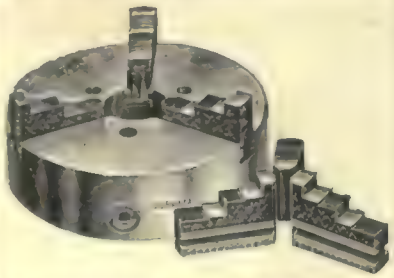
TORONTO ST. JOHN, N.B. MONTREAL WINNIPEG VANCOUVER





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Their accuracy and reliability have been proven over and over again and the name "Cushman" on your chuck is a guarantee of satisfaction.

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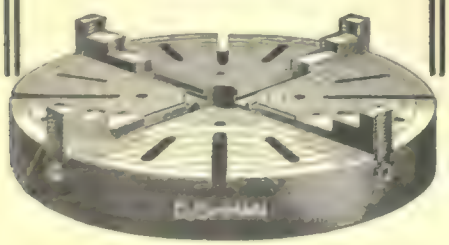
Hartford, Conn., U.S.A.

Established 1862





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St. John, N.B. Vancouver, B.C.

*In the United States, Simonds Mfg. Co.*


$12,000,000 with $4,000,000 reserve. A. P. Horner is the local manager.

**Montreal, Que.**—The president of the National Hydro-Electric Company has reported that water power capable of developing $16,000 horse-power has been acquired at Carillion by the company, and that they are seeking to have the privelege of bringing more power to the city of Montreal. The installation will cost $10,000 and the small plant belonging to the company will soon be in operation.

**Hanley, Sask.**—The town has awarded the contract for the supply and the erection of an electric lighting installation to the British Canadian Engineering and Supply Co. This consists of a 50 brake horse-power Ruston Proctor producer gas engine and plant, together with all electrical equipment both for the inside and outside or the power house. The town of Wadena, Gull Lake and Outlook, have also contracted with the same firm for similar machinery.

**Renfrew, Ont.**—The town's power development plant is now finished, and many local industrial concerns are already patrons. After supplying these with power, there will be 400 horse-power left over.

**Ottawa, Ont.**—Two hundred and seventy-four miles of trackage to be operated by gas electric equipments is one of the features of the Ottawa and St. Lawrence Electric Railway, the survey of which is now nearing completion. It is going to be a system that will benefit the farmers along the route from Ottawa to Morrisburg, with several branch lines. The road is to be further extended from year to year until the whole of eastern Ontario will be served by an up-to-date standard service touching all the towns and villages within a line drawn from the city of Kingston to Pembroke and from the St. Lawrence river to Hawkesbury.

### GENERAL MANUFACTURING.

**Toronto, Ont.**—The Harbor Commissioners recently leased a lot 200 by 425 ft. on the Ashbridge's Bay property to G. S. Lindsay, an interior woodwork manufacturer of Walkerville, who agreed to erect a large factory there, commencing operations in the Spring. Mr. Lindsay will pay $1,500 per year for the property. The commissioners based the price at the rate of 5 per cent. of the valuation of the property, which is held at $15,000 per acre. The lot is 2.52 acres in area. The factory will be of brick, concrete and other permanent material, and the lessee agreed to employ at least 40 men a year.

**Palmerston, Ont.**—The Worldridge factory, recently taken over by the Taylor-Scott firm of Toronto, is being remodelled. The factory, which is under the management of Messrs. L. E. C. Thorne and H. M. Perry, manufactures wooden ware and employs about fifty men. Among the improvements contemplated are a new heating and lighting system and laboratories. A contract has been signed by the Taylor-Scott Company with the Grand Trunk Railway for a new siding. A new machine shop has also been added.

**Welland, Ont.**—Further details have been made known, since the last issue, about the establishment of the Empire Cotton Co. The machinery is to cost $750,000 and power will probably be procured from the Ontario Power Company. The factory will use 8,000 bales of cotton per year and will turn out about 3,000,000 pounds of finished goods per annum. Mr. Grautham is president.

**Montreal, Que.**—An agreement has been reached between the city of St. John, Que., as first party and D. Lorne McGibbon, of this city as second party, whereby the latter agrees to deposit $100,000 as a guarantee that they will erect and have completed in two years a sugar refinery with an output of 2,000 barrels per day. The plant and building will cost $1,000,000.

**Prince Albert, Sask.**—The city council has ratified an agreement with H. C. Struchen, of Minneapolis, whereby Prince Albert will secure a $250,000 pulp and paper mill. The company asks for a free site of 15 acres but do not ask for a cash bonus or a guarantee of bonds. The site must have a small amount of water frontage.

**Tillsonburg, Ont.**—Fire recently destroyed the local pork factory to an extent of $40,000, partly covered by insurance. It is the object of John Lowden, the owner, to rebuild. It was his intention to build an addition costing $200,000, but he will now have an entirely new building.

**Brandon, Man.**—It is the intention of the E. V. Donaldson Co. to start construction work on their three storey boot and shoe factory in the coming year. At a conservative estimate it is stated, the concession granted to this company is worth easily $25,000; but it is believed that the value of the resulting benefits to the city will far exceed this sum. The new company is to be a Manitoba corporation capitalized at $75,000, the agreement with the city requiring that this amount of stock be fully paid up by June 1 next, and that all employees of the company be Brandon residents.

**Lethbridge, Alta.**—It is possible that in the near future the Taylor Milling Company may erect a flour mill here. The above mentioned firm will do this only on condition that they receive from the city the same concessions as were given to the Ogilvie Milling Company by the city of Medicine Hat, viz., a 20-acre site, free; free power for 15 years; water at cost, and exemption from taxation.

**Calgary, Alta.**—Work will be commenced within a month on a paper factory in Calgary to cost $75,000. Coarse grades of paper and cardboard will be manufactured out of straw. This will be the only plant of the kind in Canada, although there are a number of similar factories in the United States. The company who will build the plant is controlled by a Vancouver syndicate. The factory when in operation will employ fifty men.

**Hanover, Ont.**—The Fisher-Sander Co., of Berlin, manufacturers of sanding and rubbing machinery, proposes to operate in Hanover, and a company with an authorized capital of $40,000 is in course of formation.

**Medicine Hat, Alta.**—One of the most important deals, from an industrial viewpoint, if from no other, has taken place here recently: Warren Overpack has purchased the Purmal Brick Co's. plant, and the clay bed from Birnie Bros. for $150,000. The plant had been in the hands of the last named for thirteen months.

**Lindsay, Ont.**—The burgesses of this town will have the opportunity soon to add another industry to the present list of enterprises in the form of a furniture factory. An agreement has been drawn up between Frank W. Roy Fisher as first party and the town as second party, whereby the first party agrees to install $10,000 worth of machinery; carry out $3,000 of repair work to the Tudhope factory, already purchased for $20,000, and operate a pay-roll of $8,000 for four months previous to having goods marketed. In turn, the second party agrees to guarantee the bonds of the company about to be formed to the extent of $30,000 and to consider void all taxes against property.

**New Westminster, B.C.** — The Canadian Wheel & Wagon Co. has secured a building on Front Street here, and is about to commence the manufacture of the Tomlinson's patent, or 20th century wheel. New machinery has been installed, and efforts are being made to cope with the incoming orders. The above company is strongly supported by local men, and the field is open for a large output.

**Preston, Ont.**—The burgesses here declared themselves in favor of aiding the Anchor Bedding Co. by the loan of $25,000 in the erection of a factory. The firm, on the other hand, agrees to erect a factory 180 by 60 feet, two storeys high, with a moulding shop, and will employ at least fifty hands the year round.

**Regina, Sask.**—P. D. Hives, president of the Saskatoon Tent and Mattress Co., recently visited this city in connection with the transferring of the said company's factory and property to a local firm, viz., Stainco, of Regina, Limited. The new company anticipates to be able to manufacture woven wire, springs, cots, couches, roll-ups and mattresses. They hope to add to the present building, which is one of the finest in the Dominion.

### SAW AND PLANING MILLS.

**New Westminster, B.C.**—Fire, estimated to have caused in the neighborhood of $200,000 damage, recently occurred in the mills of the Canadian Western Lumber Co. Eight dry kilns were gutted and over 500,000 feet of lumber was destroyed. The fire started in the dry kilns, but its origin is a mystery. It is believed that the loss is covered by insurance.

**Milverton, Ont.**—The local mill known as the Milverton planing mill, was recently damaged by fire. The interior is very much damaged, but the exact loss entailed or the origin of the fire is not known.

**Nanoose, B.C.**—The large sawmill here, owned by the Empire Lumber Co., is completed. The mill has a capacity for handling 150,000 feet per day, and has splendid prospects owing to its location.

**Abbotsford, B.C.**—Messrs. Hill, Tout and Anderson have established a sawmill near here for the cutting of ties. The company has secured a contract for eight months. A twenty horse-power electric motor has been installed, power being derived from the Western Canada Power Co.

**Trenton, Ont.**—The sawmill owned by Claude A. Nantin, of Gull Creek, was totally destroyed by fire. As the mill was not in operation at the time and there was no fire in the vicinity, the blaze is believed to have been of incendiary origin. The loss is estimated at about $1,600.

**Moncton, N.B.**—What is said to be the largest deal in lumber in this province has just taken place. The deal is the purchase of lands, mills and other properties of the

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Oil Tempered
Steel
Springs
—for every purpose and the best for each use.
Special styles of all kinds to order.
THE CLEVELAND WIRE SPRING CO.
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GREY IRON CASTINGS.
All weights up to 6,000 lbs.
We make a specialty of difficult cored work
LET US FIGURE ON YOUR REQUIREMENTS
GALT FOUNDRY CO. GALT, ONT.

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It has, in the 20 years it has been in use, proven that it is the union of the highest efficiency.

It is easily connected, whether pipes are in or out of line.

Both sections of the **Dart** are seated with solid **non-corroding bronze** machined and ground to a true ball joint.

**Take out the best insurance against loss and expense** that comes with leaks, also against replacement costs.

The **Dart** must "make good." If any are found defective they will be replaced two for one.

**Your jobber sells them.**

**DART UNION CO., LTD., TORONTO**

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## POWER PRESSES

For Rapid Production of
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**TORONTO, ONT.**

Our 25-lb.

## Power Hammer

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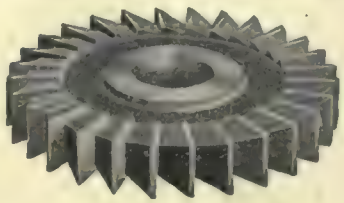

## National Cutters

Will increase the efficiency of your men and your machine.

Will give the longest and most satisfactory service.

They are made from the highest stock by the most approved methods and are fully guaranteed. A trial will convince.

WRITE FOR CATALOG B.

**THE NATIONAL TOOL CO.**

Cleveland
*Sixth City*

Scott Lumber Company. The purchasers are Donald Fraser and Sons. The sale consists of 52,000 acres of timber land, 32,000 of which is freehold.

**Coquitlam, B.C.**—Actual construction has been commenced on the saw mill to be built on the site of the Coquitlam Shipbuilding & Marine Railway Company at Pitt River. This mill will be 160 feet in length by 50 feet in width. A contract for sawmill machinery, costing more than $22,000, has been let in Vancouver by the president, L. D. Shafner, to the Pacific Machinery Co. The machinery ordered will be sufficient to turn out from 25,000 to 30,000 feet per day. The Western Canada Power Co. will furnish electric power.

**Montreal, Que.**—Fire recently broke out in the sash and door factory of Victor St. Andre & Fils. The flames spread so quickly that despite the strenuous efforts of the fire brigade the building was consumed. The total cost is estimated at $30,000.

**North Lake, Ont.**—The lumber yards of A. Bishop & Co. were destroyed by fire. The value of the lumber is estimated at about $30,000. The origin of the fire is unknown, but it is supposed to have originated by a spark from the mill.

**Lindsay, Ont.**—The loss sustained by the Baker Lumber Co. amounted to $9,000. This was fully covered by insurance, and it is the intention of the owner to rebuild and have the new mill ready by April next.

### BUILDING NOTES.

**Vancouver, B.C.**—Two new post office substations are about to be built here. Sites for the same have been secured, and plans for the buildings, each of which will cost $100,000, have been prepared.

**Winnipeg, Man.**—Work has practically been finished on the $300,000 structure of the Dominion Express Co., and it will shortly be occupied. No expense has been spared to make the building worthy of the company. It is 94 and 48 feet wide and 277 feet in length.

**Toronto, Ont.**—A by-law to provide money for the building of bridges has been introduced in the City Council. It is proposed to erect the following bridges: Crawford Street bridge, to cost $29,450; Strachan Avenue bridge, $58,000; Riverdale foot bridge, $12,000: Gerrard Street bridge, $200,000; Weston Road bridge, $14,000, and Dundas Street bridge, $11,800.

**Regina, Sask.**—It has been decided by McCallum and Hill to add two more storeys to their new building on Scarth Street. The original plans were for eight storeys, to cost $325,000. Being ten storeys high the building will be the highest in the province. The promoters intend to put in their own power plant, and the additional storeys will necessitate three elevators instead of two, as at present planned.

**Ingersoll, Ont.**—Messrs. Nagle & Mills have been awarded the contract for the erection of the proposed Imperial Bank building at the corner of King and Thames Streets. The buildings will be of red brick and cut stone, and will cost about $30,000. Work on its erection will be commenced in the spring.

**Moose Jaw, Sask.**—A large building enterprise is about to be launched here in the form of a new hotel, to cost about $700,000. W. L. Brackett, who is the promoter, has offered to bear 65 per cent. of the cost. The building will be twelve storeys high, and will be leased for thirty years. It will have 110 feet of frontage and 80 feet depth. The location has not been decided yet.

**Weyburn, Sask.**—A new hotel, to cost $100,000, is to be built here in the near future. The structure will be located on Government Road, and will be four storeys high, fireproof and modern in every respect. It will have 100 rooms, with provision for an additional 100 if necessary. Plans for the same are being prepared by De Brewere & Boyum, architects, of Weyburn.

**Vancouver, B.C.**—The Norton Griffiths Steel Construction Co. have been awarded the contract and have commenced ork on the construction of the Merchants' Ice and Cold Storage Co.'s warehouse. The building will be 300 feet long and 100 feet wide, and two storeys high. Reinforced concrete will be used in construction throughout. It will be fitted with rolling doors and metal-framed windows. The cost will be $175,000.

**Winnipeg, Man.** — Work is progressing quickly in connection with the new agricultural college, administration dormitory, horticultural and biology, chemistry and physics buildings will soon be finished. Boilers are being installed in the power house, and tunnels for light and heat purposes are already built. The completed work will cost over $5,000,000.

**Winnipeg, Man.**—Extensive alterations to the Royal Alexandra Hotel and the local station are planned by the C.P.R. Work will be commenced in a few weeks. The cost

will be about $1,000,000. The extensions and alterations will be so general that the whole appearance of the C.P.R. block will be changed, and the improvements will affect the hotel and station, both of which will be practically doubled in size. A large grill room, a ballroom and banquetting hall, besides 300 new bedrooms will be the principal additions to the hotel. The station itself will be practically doubled in size by moving the front forward, and so bringing it level with that of the Royal Alexandra.

**Vancouver, B.C.**—Instead of building a central section of eleven storeys, to cost about $800,000, according to the plans filed at the building inspector's office, the C.P.R. will extend part of its new Hotel Vancouver structure up some sixteen storeys. The cost of the central section to be made sixteen storeys high will run to about $1,200,000 instead of $800,000. The building inspector expects to grant a permit for it well before the end of the year.

**Winnipeg, Man.**—The new building of the James B. Brown Co., on Notre Dame Avenue and Home Street, is now completed. The building is three storeys high, with basement, 75 by 100 feet, and will cost $50,000. Plans were drawn by Edgar Prain, and the building was erected by Clayton Bros.

### NEW INCORPORATIONS.

**The Fisher Machinery Co., Ltd., Hanover, Ont.**, has been incorporated at Ottawa with $50,000 capital to conduct an iron foundry and machine and repair shop, and to manufacture and deal in machinery. The incorporators are Daniel Knechtel, Jacob Stadelbauer Knechtel, Henry Peppler, William Henry Fisher, Benjamin Frederick Ahrens, Henry Horton Miller, James Henry Adams, Henry H. Engel and Arthur William Fisher, all of Hanover.

**The Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.**, has been incorporated at Ottawa with a capital stock of $150,000, and the following incorporators: Hobart Anderson Springle, Sidney Cecil Robinson, Walter Chater, Edgar Francis Ladore and Hiram Holicomb Walker, all of Walkerville. The company will manufacture and deal in machines, engines, tools, instruments and mechanical and electrical supplies.

**J. B. Baillargeon Express, Ltd.**, has been incorporated at Ottawa with Montreal head office, to manufacture and deal in tools, implements, motor and other vehicles, engines, steam plants, etc. It has an established capital of $1,500,000, and its incorporators are Messrs. Clovis Joseph Baillargeon, of Outremont, Que.; Romeo Gaudry, George Lefort, Rene Beauchemin, and Joseph Treffle Primeau, all of Montreal, Que.

### CATALOGUES.

**"What We Make"** is the title of a compact 48-page book issued by the Green Fuel Economizer Company, of Matteawan, N.Y., describing fuel economizers, both standard and special, coverings for fuel economizers, mechanical draft outfits, heating, ventilating and drying outfits, hot blast heaters, steel plate fans, motor and engine driven fans, cast iron volume blowers, slow speed and standard speed planing mill exhausters, fan and cone wheels, wool wheels, ventilator wheels, propeller fans, vertical and horizontal engines, and mechanical draft dampers.

**"Hydraulic Leather Belt Presses,"** catalogue No. 88, published by the Watson-Stillman Co., 50 Church St., New York, is just off the press. It illustrates, describes and lists six distinct types of leather belt presses built by the Watson-Stillman Co., and in addition shows types that are generally used in conjunction with their hydraulic presses. A free copy will be sent on request.

The velocity stage type of DeLaval steam turbines is described in a 48-page booklet recently issued by the **DeLaval Steam Turbine Company, of Trenton, N.J.** This turbine, with a single pressure stage, is built in sizes up to 600 H.P., and is suitable for direct connection to centrifugal pumps and blowers and small A.C. and D.C. generators, etc. With the intermediation of gears, the turbine may be adopted to drive slow and standard speed machinery, also for use with rope or belt drives. The pamphlet outlines the factors affecting the suitability of different types of turbines for the several services involved; the speed problem as bearing upon the type of turbine to be selected; methods of velocity staging for small turbines, such as the use of multiple rows of buckets with intervening guide vanes, or returning the steam jets upon the original row of buckets, and practical considerations, such as renewability, governing, non-penetrable casings, shaft design and freedom from vibration, bearings, the strength of wheels, the best form and material of buckets to resist erosion, ease of access to internal parts, economy, facilities for changing the nozzles to meet changes in steam conditions, etc. This form

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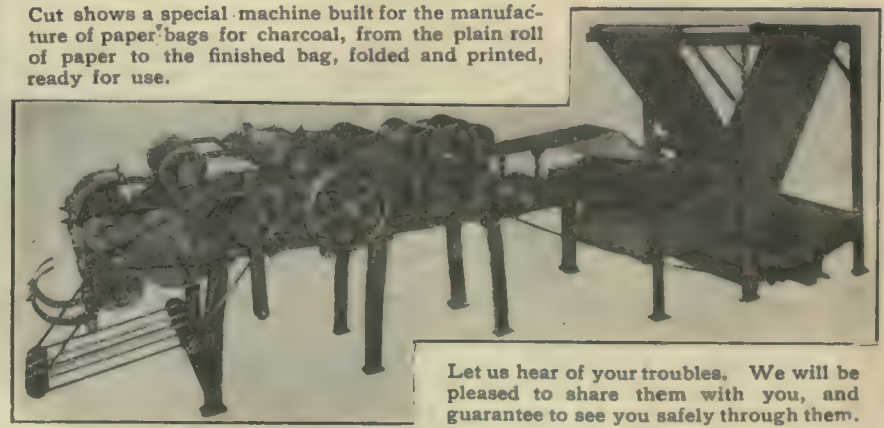

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of turbine is built for all steam conditions, i.e., receiving high pressure steam and exhausting to condenser or atmosphere, or against back pressure, or operating on low pressure steam, either alone or with mixed flow. Copies of the book will be sent gratis to those interested in steam power plant equipment.

**Jenkins Bros., Ltd., Montreal,** have favored us with a copy of their latest pocket catalogue and price list of their globe and gate valves and other specialties.

**Jeffrey Mfg. Co., Montreal,** have issued Bulletin No. 74, which consists mostly of numerous excellent half-tones illustrating various types of freight and package-handling machinery, elevators, conveyors, etc.

**The Eastern Machinery Co., New Haven, Conn.,** send us the price list No. 6. In this are described the firm's line of improved Frisbie friction clutches, clutch pulleys, etc.

**Tate, Jones & Co., Inc., Pittsburgh, Pa.,** have issued a well gotten up catalogue of their appliances for burning fuel oil. These include burners for boilers, kilns, steel furnaces, etc., etc. A section of the book deals with pumping systems for distributing fuel oil at a uniform pressure over large systems.

**The British Anti-Vibration & Noise Co., Ltd., Glasgow, Scotland,** are specialists in the isolation of vibration and noise caused by machinery. They have forwarded to us a copy of their booklet, which sets forth the manner in which the desired end is accomplished. The method, it is claimed, is entirely successful, and can be applied to all kinds of machinery.

**The Agnew Electric Welder Co., Ltd., Walkerville, Ont.,** have mailed us a bulletin descriptive of their line of Butt and Spot Welders. One of the principal advantages in favor of these machines is their very low current consumption, a point that will appeal strongly to prospective purchasers. In the butt-welders particular attention has been paid to the means for bringing parts to be welded together into quick yet accurate alignment. The movable carriage is of extra length, with bearings so disposed that perfect alignment is positively assured. Parties interested are invited to write for this bulletin.

**The Canadian Bond Hanger and Coupling Co., Alexandria, Ont.,** have issued Catalogue 25, dealing with their line of power transmission equipment. The various hangers, brackets, pillow blocks, etc., are made both with ring oiling or grease lubricated bearings. The bond graphite bearing is also a favorite, especially in silk or fabric mills, where cleanliness is so essential. Another well known line is the Lytestrong steel shaft hanger which is scientifically constructed, the metal being folded to give a maximum of strength and rigidity with a minimum of weight.

**The Canada Wire & Iron Goods Co., Hamilton, Ont.,** have mailed us a copy of their latest catalogue No. 3. The firm specializes in ornamental wire and iron work, brass wire goods, elevator enclosures, wickets, window guards, grilles, gates, etc., etc. In fact the firm's slogan "If it's made of wire, we make it," sufficiently indicates the field covered.

**The Dodge Mfg. Co., Toronto,** have forwarded a copy of their "Condensed No. 30" price list, which gives recently revised prices of the leading lines of transmission equipment manufactured by the firm, such as wood and cast iron pulleys, friction clutches, floor stands, hangers, pillow blocks, mule stands, rope sheaves, etc., etc.

**The L. S. Starrett Co., Athol, Mass.,** recently favored us with a copy of their latest catalogue of the well-known Starret steel rules, micrometers, bevel protractors, speed indicators, etc., etc.

**M. Beatty and Sons, Ltd., Welland, Ont.,** are sending out a finely illustrated bulletin showing examples of their hoisting engines, centrifugal pumps, derricks, dredges, scows and clamshell buckets. The production is very elaborate to be called a bulletin, but the firm so style it themselves and explain that it is being issued pending the compilation of a more complete new catalogue.

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**The Emmert Mfg. Co., Waynsboro, Pa.,** have issued a handy little catalogue of their well-known line of vises for patternmakers, toolmakers and machinists. The Emmert universal vise is too well known to call for extended comment here.

# Classified Advertisements

## MACHINERY FOR SALE

MACHINERY FOR SALE—NEW AND SECond-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

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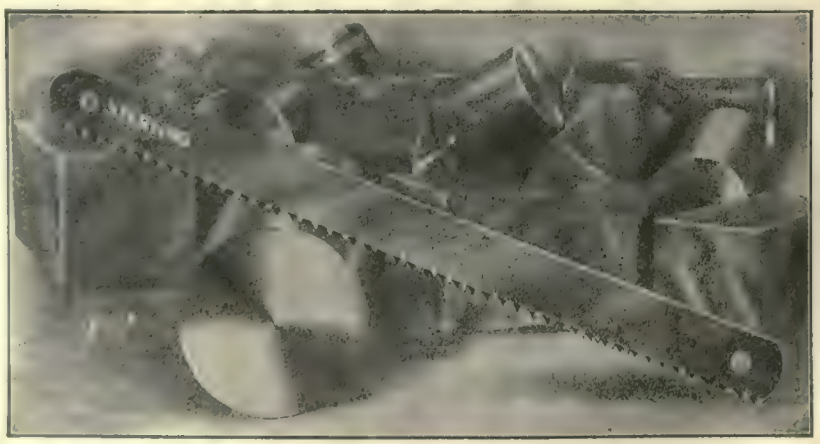

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